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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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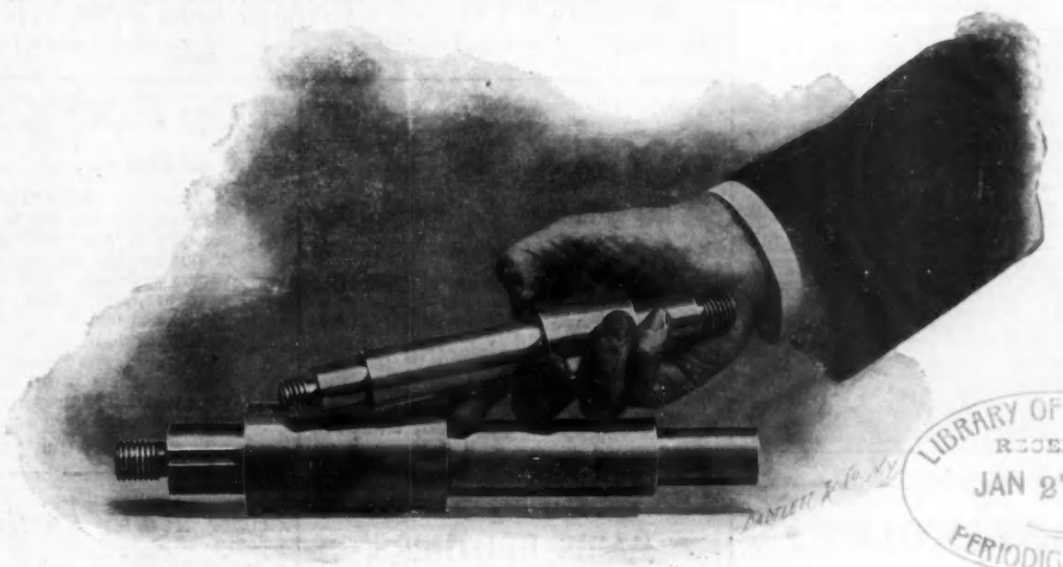
Contents and Index to Advertisers, Page II.



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Index to Advertisers.

	PAGE
Acme Machinery Co	16
Adams Co., The	45
Albro-Clem Elevator Co	43
Almond, T. R	38
American Gas Furnace Co	2
American Tool & Machine Co	44
American Tool Works Co	14
American Turret Lathe Works Co	45
Armstrong Bros. Tool Co	45
Armstrong Mfg. Co	4
Backus Water Motor Co	41
Baird & Co., Henry Carey	41
Baird Machinery Co., U	13
Baker Brothers	10
Baldwin, Davidson & Wight	9
Ball Bearing Co	16
Barnes & Co., W. F. & John	5
Bartlett, Edwin E	8
Beaman & Smith	10
Becker Mfg. Co., John	2
Bement, Miles & Co	40
Berlin Iron Bridge Co	13
Besly & Co., Chas. H	48
Bethlehem Foundry & Machine Co	46
Bethlehem Iron Co	9
Bickford Drill & Tool Co	39
Bilgram, Hugo	9
Bliss Co., E. W	47
Blood, L. H	41
Boston Gear Works	41
Box 44	7
Brandywine Machine Works	39
Bradford Belting Co	9
Bradford Mill Co., The	42
Bradley Co., The	37
Bristol Co	48
Brown & Co., R. H	3
Brown & Sharpe Mfg. Co	48
Buckeye Engine Co	9
Buffalo Forge Co	48
Builders' Iron Foundry	2
Bullard Machine Tool Co	40
Burt Mfg. Co	38
Carborundum Co., The	6
Card Mfg. Co., S. W	44
Case Mfg. Co	6
C & C Electric Co	45
Chandler & Taylor Co	46
Cincinnati Milling Machine Co	42
Cleveland Gear Works	38
Cleveland Machine Screw Co	4
Cleveland Twist Drill Co	48
Clough, R. M	39
Coffin & Leighton	44
Cook Co., Asa S	3
Crescent Steel Co	37
Crosby Steam Gage & Valve Co	8
Curtis & Co., Mfg. Co	9
Curtis & Curtis	4
Cushman Chuck Co	3
Dallett & Co., Thomas H	40
Davis Machine Co., W. P	16
Dayton Globe Iron Works Co	46
Detrick & Harvey Machine Co	4
Diamond Machine Co	44
Dietz, Schumacher & Boye	8
Dixon Crucible Co., Joseph	13
Doan & Co., J. B	7
Draper Machine Tool Co	13
Dreses, Mueller & Co	8
Dwight Slate Machine Co	8
Eames Co., G. T	8
Errington, F. A	3
Evans Friction Cone Co	7
"Exports"	7
Faneuil Watch Tool Co	48
Fellows Gear Shaper Co	10
Fifield Tool Co	48
Fitts Mfg. & Supply Co., Frank E	7
Flather & Co	16
Foos Gas Engine Co	46
Forbes & Co., W. D	46
Fox Machine Co	16
Frasse Co., The	38
Frick Co	46
Garvin Machine Co., The	47
General Electric Co., The	6
Geometric Drill Co	3
Gisholt Machine Co	45
Gleason Tool Co	48
Goodyear, S. W	4
Gould & Eberhardt	16 and 43
Grant Gear Works	16
Grant Machine Tool Works	8
Gray Co., G. A	16
Haeseler Co., C. H	45
Hamilton Machine Tool Co	44
Hampden Corundum Wheel Co	3
Hartford Steam Boiler Insp. & Ins. Co	39
Hart Mfg. Co	8
Henderer's Sons, A. L	13
Hendey Machine Co	36
Hill, Clarke & Co	7
Hobson, Seaman & Co	37
Hoggson & Pettis Mfg. Co	3
Horseless Age	46
Horton & Son Co., E	3
Howard Iron Works	13
Hunt Co., C. W	41
Hurlbut-Rogers Machine Co	3
Hyatt Roller Bearing Co	2
Ingersoll-Sergeant Drill Co	41
International Correspondence Schools	40
Jenkins Brothers	37
Jessop & Sons, Wm	9
Jones & Lamson Machine Co	1 and 16
Kempsmith Machine Tool Co	4
Keuffel & Esser Co	39
Keystone Electric Co	5
Kolbe, Robt	2
Landis Tool Co	45
Le Blond Machine Tool Co., R. K	48
Le Count, Wm. G	3
Lodge & Shipley Machine Tool Co	7 and 12
Long & Allstatter Co	10
Lucas & Gliem	16
Main Belting Co	41
Maris Brothers	2
Marshall & Huschart Machinery Co	7
McCabe, J. J	7
Merrell Mfg. Co	4
Mietz & Weiss	46
Montgomery & Co	3
Moore Cycle Fittings Co	7
Morrison & Co., Thos	7
Morse Twist Drill & Machine Co	15
Morse, Williams & Co	8
Morton Mfg. Co	13
Mossberg & Granville Mfg. Co	43
Newark Machine Tool Works	7
New Doty Mfg. Co	46
New Era Iron Works	46
New Haven Mfg. Co	6
New Process Raw Hide Co	8
New Process Twist Drill Co	6
Newton Machine Tool Works, Inc	9
Nicholson File Co	38
Niles Tool Works Co	7
Norton Emery Wheel Co	41
Oesterlein Machine Co., The	16
Oster Mfg. Co	45
Palmer Brothers	46
Pearson Machine Co	48
Pierce Engine Co	46
Pond Machine Co., L. W	15
Pond Machine Tool Co	40
Powell Planer Co	37
Pratt & Whitney Co	5
Pratt Chuck Co	3
Prentice Bros. Co	12
Prentiss Tool & Supply Co	6
Q & C Co	9
Quint, A. D	13
Rand Drill Co	46
Reed Co., F. E	41
Reeves Pulley Co	41
Reinecker, J. E	47
Rogers Boat, Gage & Drill Works, John	42
Rue Mfg. Co	46
Safety Emery Wheel Co	6
Saunders' Sons, D	13
Sawyer Tool Co	7 and 39
Sebastian Lathe Co	37
Sellers & Co., Inc., William	16
Seneca Falls Mfg. Co	44
Shultz Belting Co	16
Sibley & Ware	43
Silk, Anderson Co	14
Sittman & Pitt	2
Skinner Chuck Co	3
Slocomb & Co., J. T	13
Smith & Mills	6
Snyder, J. E	2
Sprague Electric Co	39
Springfield Gas Engine Co	46
Springfield Machine Tool Co	12
Standard Tool Co	39
Starrett Co., L. S	10
Steel Ball Co	4
Stevens Arms & Tool Co., J	4
Stover Novelty Works	4
Stuart's Foundry & Machine Works, R. J	48
Tabor Mfg. Co	46
Tight Joint Co	39
Toledo Machine & Tool Co	3
Toomey, Frank	7
Towsley, J. T. & Co	6
Trump Brothers' Machine Co	3
Turner, Vaughn & Taylor Co	9
T. & B. Tool Co	16
United Correspondence Schools	38
Vonnegut Hardware Co	7
Walker, John	10
Walker, O. S	48
Waltham Watch Tool Co	8
Warner & Swazey	48
Watkins Co., F. M	46
Watson-Stillman Co., The	44
Weber Gas & Gasoline Engine Co	46
Webster Mfg. Co	46
Westinghouse Electric & Mfg. Co	47
Whitcomb Mfg. Co	41
Whitney, Baxter D	3
Whiton Machine Co., D. E	3
Wiley & Sons, John	37
Wiley & Russell Mfg. Co	44
Williams & Co., J. H	35
Winkley, F. D	9
Woodward & Rogers	3
Woolley Foundry & Machine Works	4
Worcester Machine Screw Co	4
Wyke & Co	2
Wyman & Gordon	48
York Co., S. M	7
Young Mfg. Co., W. C	12

Contents.

	PAGE
A Typical Boiler Explosion. By W. H. Wakeman	17
Boring a Thirteen-Inch Naval Gun. By E. J. Prindle	17
Direct Utilization of Producer Gas in Europe. By E. P. Buffet	19
Overdoing Underselling	21
A Three-Spindle High-Speed Drill	22
Two New Shaping Machines	23
A Design for a Small Welding Transformer. I. By George T. Hanchett	23
Letters from Practical Men: Training at Fault. By R. W. G....Superintendent at Fault. By One of Chordal's Disciples....The Taper of Pipe Threads. By Superannuated....More Whims. By C. W. Crawford....Business Cards. By Charles Hansel....A Type Dovetailing Job. By Walter Gribben....The Rotary Blower as an Air Compressor. By Wm. Hollingsworth....For Lifting the Planer Tool. By E. R. Plaisted ....Can We Feed a Boiler for Nothing. By W. K....A Handy Clamp. By Reader....Chucking Small Bevel Gears. By S....For Improving Blank Forms, Catalogs, etc. By Robert S. Brown	25-30
Speed Regulation of Electric Motors. By Allan D. Adams	30
The Harlan & Hollingsworth Company	31
Similar to the Machinery Business	31
Business Notices	32
Back Numbers	32
Bound Volumes	32
Skilled Labor for Skilled Work	32
Post Mortem Revelations of the Keely Motor	32
Questions and Answers	33
Personal	33
Obituary	33
Places for Ship Draftsmen	34
Inquiry for Machinery	34
Commercial Review	34

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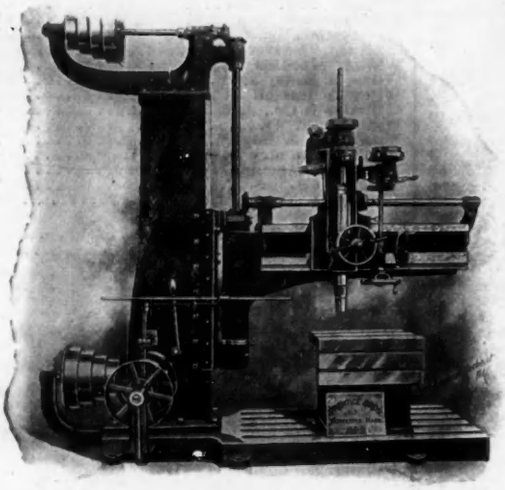

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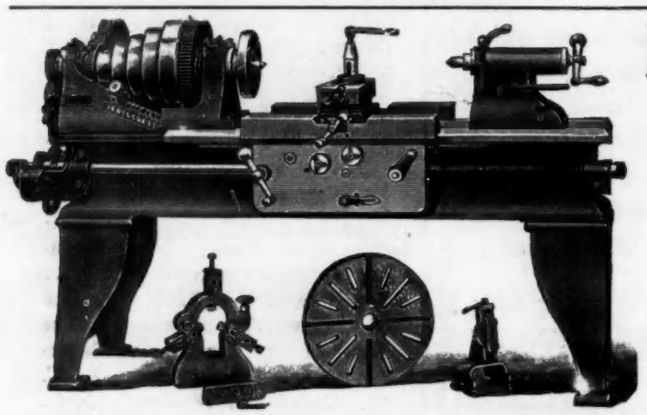

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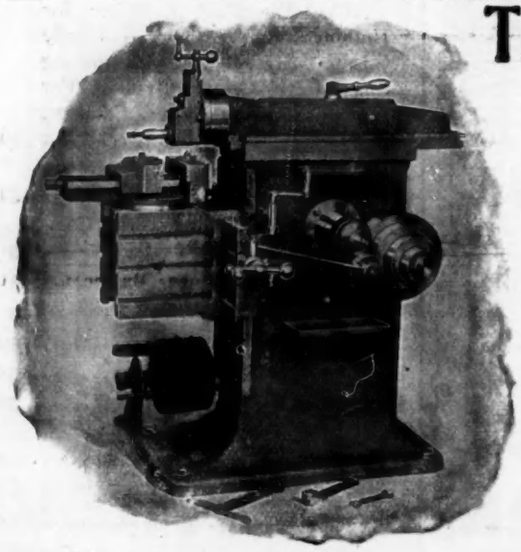

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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 22 NEW YORK, THURSDAY, JANUARY 26, 1899 NUMBER 4

A Typical Boiler Explosion.

BY W. H. WAKEMAN.

I have just read an account of a boiler explosion which deserves a passing notice, and more particularly the account given, rather than the explosion itself. It appears that a certain mill had been shut down for several days, for some reason, and when the fireman came in on the morning of the explosion he found steam already up, but no water in the glass. This leaves us to infer that some ignorant watchman had built a fire under the boiler without ascertaining that there was sufficient water in it to prevent damage. The fireman on finding the water so low, did not bank his fire and find out whether any harm had resulted, but at once started the pump, and for ten minutes a stream of cold water was forced into the unfortunate boiler. This did not cause a rupture, but when the throttle valve was opened the boiler promptly resented such treatment and at once split in two. There is one clause in the report to which I object, for it says that there could have been but one result when an engine was started up in this way, and that result a boiler explosion. It is barely possible that such a combination of ignorance and carelessness would have resulted in the boiler refusing to do further duty, but to say that there could be no other result is to put it too strongly altogether.

A working pressure of about 60 pounds of steam was on the boiler, with no water in sight, which means that nobody knew how much or how little was in the boiler, and the pump was started and run for ten minutes before the tubes were covered. This would not, of necessity, have caused an explosion, although it is a very poor plan to adopt. Fairly tried experiments under working conditions have demonstrated that water pumped into a red-hot boiler does not always explode it, but the plates are usually warped by unequal contraction, and this may be sufficient to cause an explosion.

It seems that the boiler failed when the throttle valve was opened to start the engine. Experiments have also demonstrated that this can be done, but the conditions under which it was accomplished were: a pressure of more than 700 pounds, a perfectly quiet boiler, as no steam was drawn out for any other purpose, no water going in, and the throttle valve opened very quickly. It was hard work to explode the boiler even then; but, in the case in hand, steam was drawn out to run a pump, which in turn forced water into the boiler, and the pressure was comparatively light, while we are not informed whether the valve was opened quickly or slowly.

The theory of boiler explosions resulting from opening the throttle valve too rapidly rests upon the assumption that a fire has been burning under the boiler, but that the draft is checked or the damper closed altogether, with the fire at least partially covered with fresh coal, thus stopping the circulation of the water and allowing heat to accumulate in the body of the water; but with the pump running circulation must continue.

But whatever our opinion may be concerning the cause of the trouble, the fact remains that the boiler exploded, and it is in order to look further for the cause.

In the description of the plant the statement is made that the rear part of the boiler rested upon a cast-iron stand or chair, and, as might be expected in such a place, the sheet was corroded where it rested on this stand, and when the boiler was flooded with cold water the contraction caused the failure of the plate, and that is the sum of the whole matter.

Now this boiler was located in a certain village, and as the engineer knew that it was unsafe, it is more than probable that all of the visitors at the village grocery knew it also, which means that about everybody there was aware of the fact; but still the proprietor claims that he knew nothing about it. I wonder if he supposed that he had a new boiler in his factory, or, recognizing that it was old, did he take precaution to see that it was in good order? Some steam users do not want to be told when their boilers are getting old, because they do not want to spend the money for new ones, and if the engineer wants to make a more thorough examination where the brick work prevents ready access, he is told to run the boilers just as they are or else to leave them altogether and let somebody else do it.

If a conservative man leaves such a place, some reckless person is always ready to take it. In some of our States license laws are in force which prevent engineers from operating plants (for any considerable length of time) unless they have a license to show that they are competent to be entrusted with such responsibilities, and the plan seems to work well, but even a licensed engineer cannot always make his employer repair a boiler when such work is needed in order to be on the safe side; therefore, it might be a good plan to require a steam user to pass an examination, so that it may be known whether he is fit to own a boiler or not, and if he is, let him have a certificate displayed in a prominent place in his office, and when he will not keep his boilers in good repair let his license be revoked, and let him be sent to jail if he persists in using them in an unsafe condition.

Boring a Thirteen-Inch Naval Gun.

BY E. J. PRINDLE.

Some of the finest American machine-shop practice is to be found in connection with the manufacture of naval ordnance. The heavy guns are constructed on the "built-up" principle, and it is only because of the great accuracy with which they are now constructed that they successfully withstand the pressures and shocks to which they are subjected. Guns were constructed on the same principle during the Civil War; but owing to the imperfect workmanship they were failures. According to this principle the gun is composed of three or more layers of tubes and hoops, and these parts are shrunk together so that the inner ones are in a state of compression and the outer one is under tension. When the gun is fired, the inner part, or "tube," expands and transfers part of the strain to the next part and this to the outer hoop. The "tube" must not be under sufficient compression, when the gun is at rest, to exceed its elastic limit, and the outer hoop must not be under tension, when the gun is in operation, greater than its elastic limit. It is a matter of thousandths of an inch in diameter in the turning of parts that are as much as three feet in diameter and of a length up to thirty-eight feet to proportion the parts so that these conditions exist. If a part is finished three one-thousandths of an inch too large or too small, it is rejected. The work is usually well within this limit. As a fair sample of the methods of the Naval Gun Factory at Washington, D. C., where the naval guns are built, the boring of the tube of a thirteen-inch breech-loading rifle may be taken.

The lathe on which the work is done is about 115 feet long, and cost nearly $100,000. It is the work of William Sellers & Co., of Philadelphia.* The breech

* Illustrated and described in the AMERICAN MACHINIST of May 26, 1892.

of the gun is held in an independent jaw-chuck, and two steady rests support the chase and muzzle. Outside turning is being done at the same time as the boring. The lathe has two carriages, so that turning may be done on two different portions of the gun at the same time.

The bore, which is roughed out at the works where the forging is made, is accurately bored for three feet from the muzzle with an ordinary lathe tool carried in a slide rest. This cut enlarges the bore to ninety-five one-hundredths of its final diameter, and it is for the purpose of starting a "pack bit," which type of bit alone is used in completing the boring.

The pack bit is built on a body that is square in cross-section, and has four ribs projecting from the angles of the square, making in effect a cylindrical body having four segmental grooves cut in its surface. Four cutters are fastened to the forward corners of the ribs in the following manner: Each cutter is fitted to an undercut shoulder on a block of steel, as shown in Fig. 2, and is fastened in place on the block by a screw. The block is seated on a square shoulder on the rib, and is secured to the rib by a bolt that passes through a slot in the block and a hole in the rib. To set the cutters farther out for sharpening, a strip of copper is placed between the block and the shoulder on which it rests. To further secure the cutter to the rib a segmental strip of brass is screwed into slots in the rib and cutter to bind them together. The segmental spaces beween the ribs are filled with pieces of oak that are bolted in place and which have their front ends protected by segmental plates of steel secured by screws, as seen in Fig. 2. The wooden blocks are slightly larger, radially, than the ribs.

The bit is secured to a boring bar by a taper shank on its rear end and is fed into the gun, while the latter revolves, by the forward motion of the boring bar. The bit takes its direction from a portion of the bore which has been turned to receive it, and it does not depend on the boring bar to keep it true. The oak blocks being on a slightly larger circle than the hole which the cutters make, are compressed with considerable force, and keep the bit moving in so straight a line that, at the end of the cut, it is not more than four or five-thousandths of an inch out of true. If the bit is found to be running out of true, it is drawn out and larger wood is put on it or the next larger size bit is used. In finishing the bore with the pack bits five cuts are made. The first four bits are ninety-five, ninety-seven and ninety-nine one-hundredths of the diameter of the finished bore, the last one being of course the full diameter.

At intervals during the boring, in fact several times during one cut, if necessary, the bore is tested for truth and straightness by the method shown in Fig. 4. This is done by the use of an instrument mounted on a slide rest by which a roller is held against the inside of the bore at the point to be tested, and the motion of the roller, as the revolution of the gun causes it to travel up and down, owing to the wabbling of the bore, if it be out of true, is transferred by levers to a pointer which is held on the face of a scale. The pointer is thus made to move in unison with the roller and the amount of motion can be measured on the scale. The roller is carried by the long arm of a lever that is fulcrumed on knife edges, and the short arm of the lever is linked to a shorter lever mounted above the longer lever and having at its free end a pointer which rests against a scale that is clamped to a standard. Weights on the shorter lever nearly counterbalance the weight of the roller arm. A movement of two-thousandths of an inch can be detected by the use of this instrument.

When the bore is finished and ready for rifling, it is tested to see if it is of uniform diameter by means of the "star gage." This consists of a head in which are supported three radial arms or "points" that are movable in the direction of their length. They are pressed by springs against the tapered end of a rod that passes through the center of the head. When the instrument is in place in the bore of the gun, the points are forced against the sides of the bore by moving the tapered rod through the head and thus forcing out the points. The amount of movement of the rod is measured by verniers so accurately that the diameter of the bore is given in ten-thousandths of an inch.

By these methods a bore is made that will direct a projectile with such accuracy as to place it within a circle of ten-feet radius after traveling two thousand yards.

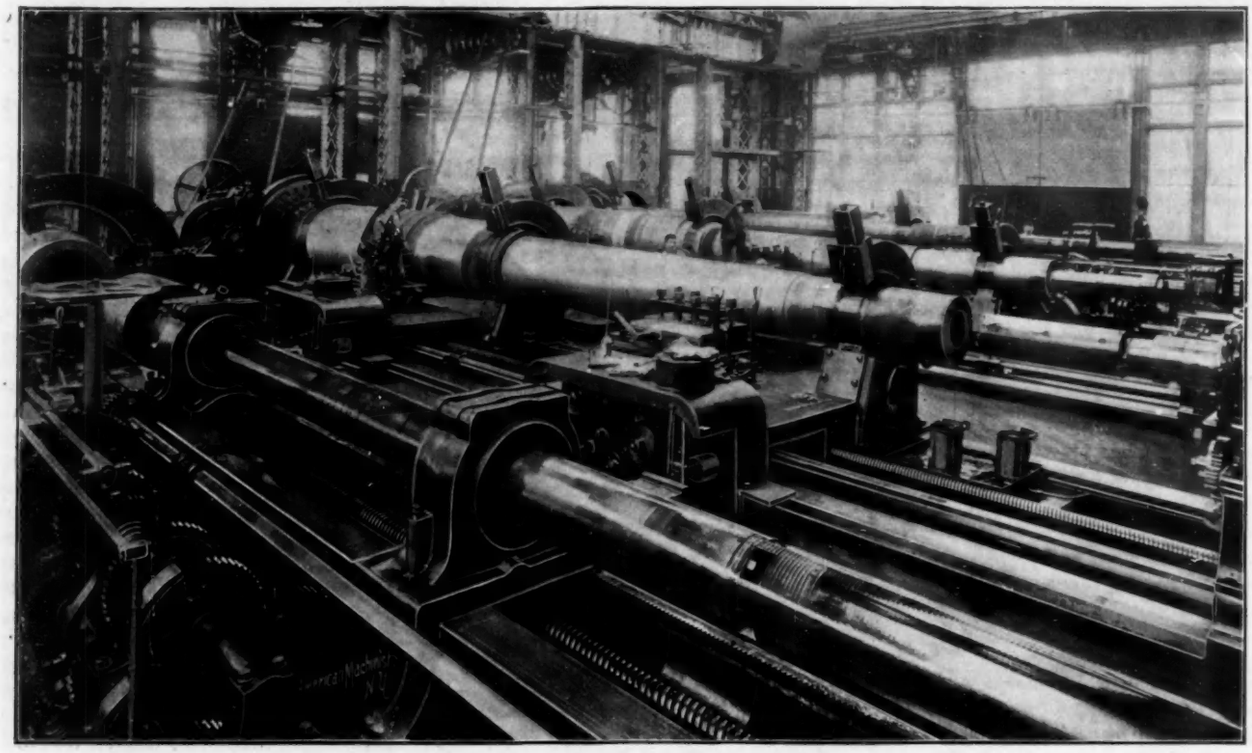


FIG. 1. BORING A 13-INCH NAVAL GUN.

Direct Utilization of Producer Gas in Europe.

In an article contributed to "Le Genie Civil," Paris (July 23 and 30, 1898), M. Aug. Dutreux, engineer at the forges of Châtillon, Commentry and Neuves-Maisons, gives a review of the results, so far as known, that have been obtained in Europe with the use of producer gas in gas engines. His data are in part obtained from previous publications and in part of his own collection. His conclusions are

FIG. 2. FRONT VIEW OF PACK-BIT.

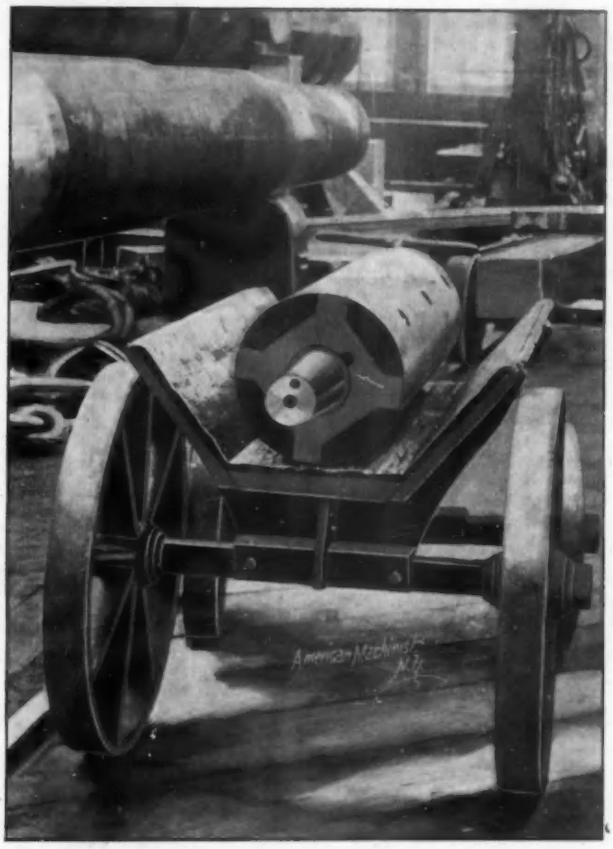


FIG. 3. REAR VIEW OF PACK-BIT.

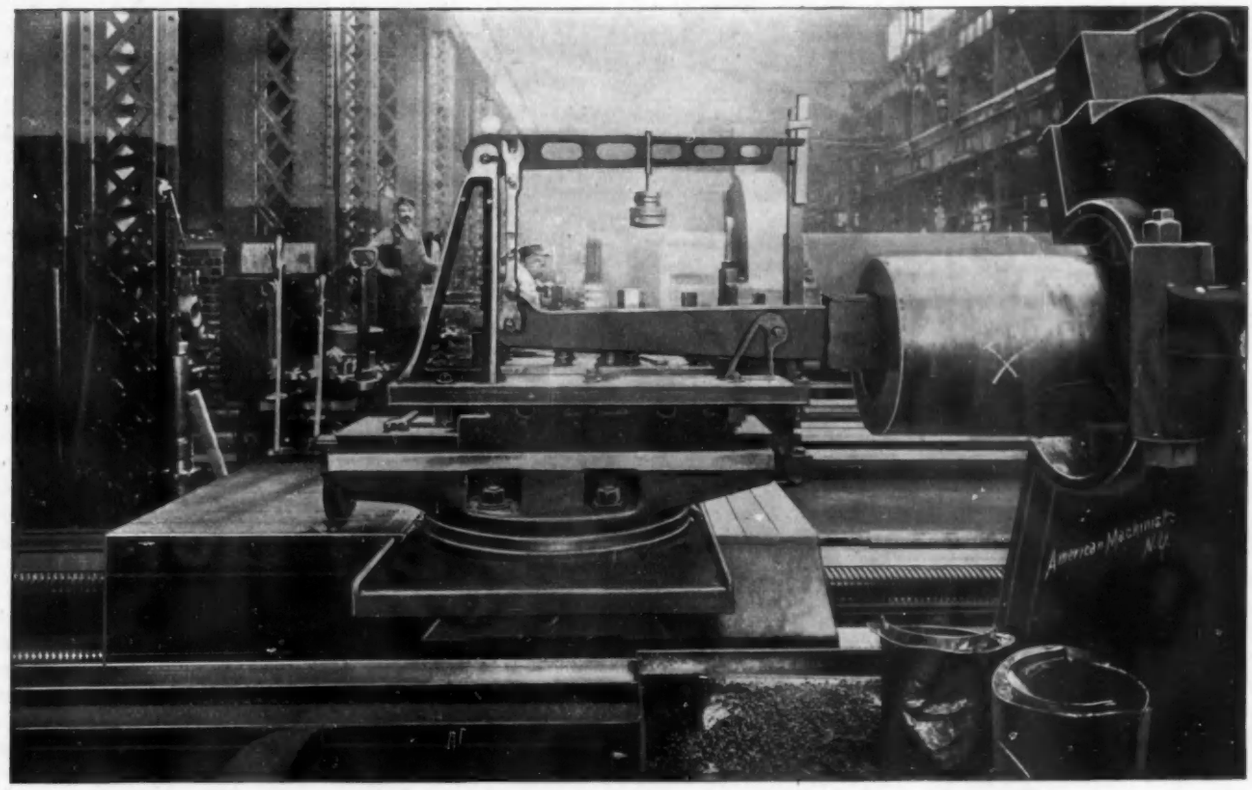


FIG. 4. TESTING THE BORE OF A GUN FOR TRUTH.

to the effect that all the objections commonly raised against this employment of producer gas can be, and have been, overcome.

Those objections are chiefly as follows:

1. Very feeble calorific power of the gas, and its variable composition.

2. Dust getting into the cylinders and wearing their mechanism.

3. Difficulties of ignition arising from the great quantity of inert gas.

4. Variations of the pressure of the gas.

5. Too great dimensions of the engine cylinders required, because of the feeble calorific power of the gas.

6. Difficulty of starting motors of high power.

In answering the first point, recourse is had to a theoretical study of producer gas by M. Hubert, Engineer of the Corps of Mines of Belgium, founded upon data obtained by Mr. Hiertz, the blast furnace manager of the John Cockerill works at Seraing, Belgium. Assuming the characteristic ratio of the operation of the furnace, that is the proportion of carbonic acid to carbonic oxide, to be .5 or .7, the calculations give, respectively, 1,166 and 1 046 calories per cubic meter of the gas when reduced to a standard of 0° Centigrade and 760 millimeters of pressure. Actual tests of producer gas made with the calorimetric shell by Mr. Witz gave a maximum of 1,084, a minimum of 961, and a mean of 997 calories with twelve samples. This goes to prove that the composition of the gas is quite constant, and it agrees with the theoretical computation in showing the calorific power to be, in decimal units, about 1,000. In a study of the subject published in "Stahl und Eisen," March 15 last, Mr. Lurman, constructing engineer at Osnabrück, Germany, gave a mean figure of 879.6 calories. In either case the power does not seem so feeble as to preclude the use of the gas, when it is remembered that the gases made in the Dowson, Buire-Lencauchez and other generators and employed in engines give only about 1,300 calories, and that the long step downward to them from 5,500 calorie illuminating gas was taken with facility.

M. Dutreux proceeds to calculate the available power resulting from the direct utilization of producer gas. Assuming, as does M. Hubert, following the experimental data of Messrs. Kennedy, Hopkinson and Beauchamp-Tower, that the efficiency of the engine in indicated work would be 21.1 to 22.8 per cent. and its mechanical efficiency 80 per cent., the effective work would be 16.88 to 18.24 per cent. The aforesaid experiments were conducted many years ago with engines of 11 to 17 horse-power, while to-day much larger ones are frequently employed, and contracts of guaranty sometimes provide for an effective work of 23 to 24 per cent. If, however, the minimum figure, 16.88, be taken, and it be assumed that 50 per cent. of the gas is utilized in the engine, M. Dutreux finds that a furnace plant of 600 tons production per day, such as that of the Société John Cockerill at Seraing, Belgium, should give 18,000 or 14,000 horse power, according as the characteristic ratio of the gas were .5 or .7. The steam power actually derived from the Cockerill furnaces is 2,300 horse power. It might be possible to obtain 3,000 in the same way, but from there to 14,000, or more, which the calculations indicate as a possibility with gas engines is a long stride.

The first attempts to employ producer gas on a large scale made in Europe have been undertaken in Great Britain, Belgium and Germany, the Scotch being, it is believed, the earliest in the field. The Belgians and Germans probably made their experiments independently of the British. The earliest patents upon the process taken out in England were by Messrs. Thwaite & Gardner. In the autumn of 1894 Mr. Thwaite proposed to Mr. James Riley, general manager of the Glasgow Iron and Steel Company, to apply it in that establishment, and a thirty effective horse-power "Acme" gas engine was installed by Mr. Thwaite in the Wishaw (Lanarkshire) furnace of that company to drive a lighting dynamo. A second installation of the Thwaite system has been made at the Frondigham Iron and Steel Works, near Doncaster. In the former case Scotch splint coal was used, and in the latter coke, and it appears that both installations have given entire satisfaction. The uniformity of operation of the engines would appear to be excellent. Mr. William H. Booth mentions having observed the engine at Wishaw for several hours and that during that time he did not notice a single miss-fire. He declared also that the variations of the voltameter did not exceed 1.5 per cent. of their normal value. At Barrow 1,000 horse-power of the Thwaite system was to be installed. By this time a part of it, at least, should be in operation.

Several installations for the use of producer gas have been undertaken in Germany. Some of the German engineers have been bitter opposers of the plan, and this is the more remarkable in view of the degree of perfection attained in that country, both in gas engine construction and in blast furnace management. The question of dust in the gas has disquieted them a good deal. Mr. Lurman exploited, last winter, the results of 143 analyses and spoke discouragingly of the large quantities of dust present in the gases. He attempted to show that the producer gas of the Georg Marienhütte near Osnabrück, would deposit daily in the cylinders of a 100 horse-power engine 29 liters of gas, occupying a volume of more than 100 liters. Mr. Greiner, who has published some results obtained at the Cockerill works, criticizes this conclusion and maintains that the dust would probably not all be deposited in the cylinders. With the use of six scrubbers described by Mr. Greiner the dust of the gas at Seraing, although considerable, was removed to a perfectly satisfactory extent. The cylinder of the large engine there, after running for three weeks continuously, showed only traces of dust. It is even stated by Mr. Kraft, of the gas so purified, that it fouled the igniting apparatus less than illuminating gas, being almost free from hydrocarbons. M. Dutreux concludes that while the arguments of the German engineers look well on paper it is possible to purify the gas as much as need be without being obliged to have recourse, as Mr. Lurman implies, to cleaning apparatus of the costly sort used for illuminating gas.

One of the German installations is at the works of Hoerde, near Dortmund, and its results are being kept secret. On a visit to the establishment M. Dutreux observed the apparatus designed for cleaning the gas. From a conduit coming from the ordinary purifiers and going to the boilers branches a pipe leading to a dry purifier of 13 to 16 feet in diameter and some 30 feet in hight. In shape it is a vertical cylinder ending at the bottom in a truncated cone. After this purifier come four scrubbers arranged in battery; finally a large reservoir or gasometer, 50 feet in diameter, which serves to store the gas, as in illuminating gas works. The engines are intended for electric work only. It is said that a triphase current will be generated and used to operate the locomotive transporting the ladle of metal from the blast furnaces to the steel works, a mile and a half away, the traveling cranes and the accessories of the rolls, but not the blowers. The engines make one effective stroke of the piston with each revolution. It is stated that the contract under which they were furnished by the Berlin-Anhaltsche Maschinenfabrik provides for the installation first of a 150 horse-power experimental engine and then of a 600 horse-power one if the results of the first one are satisfactory. If the large engine is successful another of the same model is to be put in. The arrangement of the 150 horse-power engine is somewhat complicated, and in view of the large size of the other engines for this early period in the history of the new application of producer gas an unsatisfactory result would be by no means conclusive against its value for that purpose.

It is interesting to recall the first experiments that have been made at the Hoerde works, and which, without doubt, are also the first in all Germany. They are to be placed chronologically between those of Thwaite in Scotland and of Cockerill in Belgium. On October 12, 1895, the German Otto Gas Engine Company (factory of Deutz) put in operation an engine of 12 horse power, utilizing producer gas of the Hoerde furnaces. This engine had given 12.9 horse-power with poor gas. The experiments lasted four

months and a half and gave entire satisfaction. The engine furnished 10.5 effective horse-power at the speed of 200 revolutions. The indicated work was 11.75 horse-power, corresponding to a mechanical efficiency of nearly 90 per cent. The consumption of gas was 4 cubic meters per horse-power per hour. The Otto Company did not receive the order for the new engines because they were unable to make quick enough delivery.

The Otto Company are making an important installation in Silesia, in the works of the Friedenshütte (Oberschelsische Eisenbahn-Bedarfs-Actien-Gesellschaft). The available power will be 1,000 horse-power in four units, two of 300 and two of 200 horse-power. A 16 horse-power motor used there since September, 1897, has encountered some difficulty owing to the zinc dust which comes from the minerals employed.

At the famous Krupp works at Essen producer gas is being experimented with, as applied to a "Diésel" engine, but the results have not been made public.

In Belgium some extensive tests have been conducted at the John Cockerill works, and the results have been exploited with great freedom. The first engine—a "Simplex" made by Matter & Cie., Rouen—was put in operation December 20, 1895, and gave 8 horse-power at the brake. The cylinder was 7.64 inches in diameter by 13.8 inches stroke, and the number of revolutions 210. With illuminating gas it gave 11 to 12 horse-power. This shows that with producer gas an engine can give two-thirds the power that it would furnish with illuminating gas, although the calorific power of the latter is only 850 to 1,000 as compared with 5,000 to 5,500 for the latter.

It must be observed, however, that the proportion of illuminating gas used to air admitted is one to six, while with producer gas the volumes are equal. Further, illuminating gas is used under a pressure of only about four atmospheres, while the producer gas employed in the engine at the Cockerill works was introduced at a pressure of 10 atmospheres in order to obtain a good efficiency.

The fifth objection raised at the start—that relating to the necessity of using extremely large cylinders to obtain power—seems now to have been answered.

The difficulties of ignition have been completely surmounted by the use of powerful and permanent electric sparks. During some observations made in 1897 not a single miss-fire was noticed. This seems to answer objection three.

The engines at Seraing have been found to operate well under any variations of pressure that have taken place—even, if we do not misunderstand M. Dutreux, when the pressure has fallen below atmospheric—and it must be borne in mind that the first engine experimented with was used without a reservoir. This tends to refute objection three.

The last objection which remains for us to examine concerns the difficulty of starting. With the small engine used in the experiments at Seraing there was some sluggishness in this particular, and the engine did not always start immediately. In a large engine of 150 horse-power there employed the result was accomplished by means of pinions moved by a hand lever and acting upon the fly-wheel. M. Dutreux saw this means employed at Seraing in May, 1898, and a single man succeeded in starting the engine at the first trial in 1 minute and 35 seconds. It is certain that one may without difficulty apply an automatic compressed air starter of the nature shown by Fielding & Platt, of Gloucester, at the Brussels Exposition in 1897.

The 150 rated horse-power gas engine now being tried at the Cockerill works has a cylinder of 31.5 inches diameter and 39.37 inches stroke, and a speed of 120 revolutions per minute. It is said actually to have given 203 horse-power at the brake.

M. Dutreux did not know of any works in France having an installation of engines using producer gas. The Société anonyme des fers et aciers Robert, however, had arranged with Mr. Thwaite to install a 250 horse-power engine at the furnaces of Outreau, near Boulogne-sur-Mer. A special system of purification adopted by Mr. Thwaite for coke furnaces was to be employed, and the available electric energy obtained was to be utilized at Boulogne and in the vicinity of the works.

In the Grand Duchy of Luxemburg producer gas engine installations have been made by at least two companies. At the Differdange furnaces a 60 horse-power engine intended for lighting has been put in, and a 3½ horse-power engine to start it. These engines, although made by the same company that furnished those of Hoerde, give two motive strokes of the piston for each revolution, which may be taken to imply that Hoerde's results did not show the ultimate of perfection. A definite trial of the engines at Differdange had not been made at M. Dutreux's writing. Experiments were being conducted by the Société des aciéries de Dudelange with a small experimental engine, having in view the production of 500 electric horse-power.

M. Dutreux concludes that the use of producer gas in gas engines is now becoming practicable, and that although the gas engine, because of its high speed, is not easily adapted to driving blowers it is well fitted for generating electric power for distribution throughout iron and steel mills to supplant the appallingly wasteful little engines now employed—the parasites of metallurgical works.

E. P. Buffet.

Overdoing Underselling.

Both those who are successful and those who are unsuccessful in conducting manufacturing enterprises learn, though by different ways, the importance of business methods and the need of the fullest information as to the state of the market and the ways of competitors. In the development of our foreign trade this is likely to be as strikingly exemplified as elsewhere. The American mechanic has done his share very completely in reducing the cost of production, and is daily bringing it down to still finer lines. It is one thing, however, to make things right, and quite another to sell them right, though both are equally essential to complete success. The question arises whether we as a nation are developing our abilities in both operations at the same rate, and a suggestion is at hand that we are not.

U. S. Consul Halstead, at Birmingham, England, is doing excellent work, not only in looking after American interests in the English market, but in informing the manufacturers at home as to the conditions and opportunities. A novel phase of our developing British trade is presented in recently issued advance sheets from his annual report. He first calls attention to a circular sent out by a merchant firm of Wolverhampton, Eng., to the principal bolt and nut manufacturers, the most essential part of which is as follows:

"Dear Sir—We beg to call your attention to the subjoined prices of bolts and nuts, which are those we are at present paying to American manufacturers. You will notice that the prices are from £2 to £4 per ton less than the prices at present ruling in this country. The quality of the bolts and nuts is fully equal to the very best quality made in this country. Most of our largest customers for bolts and nuts in Australia and South Africa have ceased ordering from us, informing us that they are purchasing from the United States; and others, whilst sending us their orders, instruct us to purchase from America as long as prices are so much lower than in England."

It is not necessary here to give the list of prices. The £2 to £4 per ton referred to means about 22 to 36 per cent. under the English prices.

The Birmingham "Post" comments upon the situation as follows:

"It will be seen from the circular letter reproduced in another column, which has been addressed by a Wolverhampton merchant to our leading local makers of nuts and bolts, that the competition is not confined to crude products. Messrs. Walker state that their once valuable trade in English nuts and bolts is practically killed, owing partly to the much lower prices quoted for those goods by American manufacturers, and partly to the much lower freights charged for their transport

from the United States to foreign and colonial markets, than those demanded by the same shippers for the conveyance of similar goods from this country. This latter evil is possibly only temporary, for it is almost incredible that shippers will continue indefinitely to lose money on the transport of goods, as they must now be doing, at the rates quoted on more than one line from New York, for the purpose of crushing or tiring out some rival shipping house; but the underselling of the United States manufacturers is a more formidable and, we fear, more durable danger to our trade."

* * * * *

"The simple explanation of the underselling is that the American manufacturers are able to obtain their iron and steel at prices that would be impossible in this country, owing partly to the cheapness and abundance of their ore and fuel and partly to the large scale and advanced character of their mechanical appliances."

* * * * *

"Under these circumstances it is not surprising to learn that the American nut and bolt makers are underselling us in Australia and South Africa, to both of which places just now they enjoy preferential freights. The question is a vital one for our manufacturers and their work people, for, though the nut and bolt trade, we believe, is momentarily active and prosperous, owing to the recent special activity of railway enterprise, it cannot long afford to dispense with the support of those colonial and foreign markets of which American makers are now obtaining a virtual monopoly."

Consul Halstead's remarks upon this state of affairs are out of the usual line and are of the highest importance. They are commended to the attention of all who have or who expect to have any foreign trade, and sometimes the lesson might not be amiss for the home market. He says:

"There are 20 shillings with a 24-cent value each in a pound sterling, and my comment on the Walker circular is that every time an American concern sells nuts and bolts abroad at £2 less than the British price there is a loss to the American seller of about 38s., or $9.24 a ton, of possible profit, and that every time the British price is broken £4 a ton there is a loss of possible and reasonable profit of 70s., or $17.03, a ton. It might be reasonable to underbid 5s. or 10s. or even 15s. a ton, but why beggar the markets of the world by slashing prices in this way?

"When the English were the cheapest and the greatest manufacturers in the world they filled their country with untold wealth, because they were also the best traders; and their prices abroad were based on what they could get, and not on the cost of manufacture plus some insignificant profit.

"Now that we can manufacture some things (we manufacture nearly everything as cheaply as any people) at tremendously reduced cost, why should we give away more of our advantages to the world at large than is necessary to get the business? No one can say that it is necessary to underbid £2 or £4 a ton in order to capture the nut and bolt business, and, if a trade trust ever was right, it would seem to be legitimate to form one now in the bolt and nut business of the United States, in order to handle and protect the export trade. This beggaring of business, these unnecessarily low prices, this absurd underbidding on the part of Americans, is constantly brought to my attention here, and it is so foolish that sometimes it is fairly heartbreaking. I am having some facts and figures prepared, and hope to make a showing of how general it is."

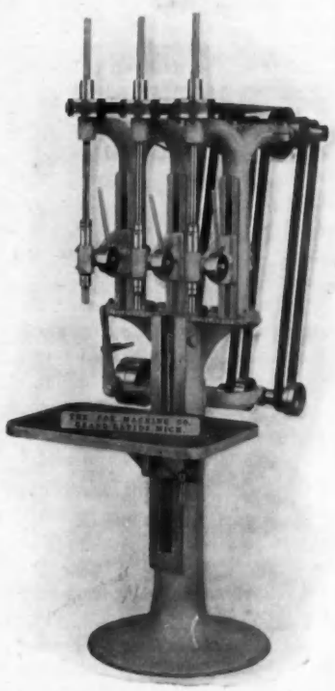
He then quotes the following remarks of an English manufacturer occurring in the course of a recent interview:

"Business is business, and when your people can sell cheaper they certainly should and will make the sales, but I very much fear that, owing to their inexperience in foreign trade, they are going to demoralize prices the world over. When big profits are in sight and possible, they seem ready to give away the benefits of your grand natural resources, of your manufacturing brains and tremendous energy, to Kaffirs, Cape Colonists and other Africans; to Australians, West Indians, South Americans, Japanese, and even to the 'heathen Chinee,' for a petty profit, simply because they have no knowledge of foreign trade and certainly no trade patience. They will lower all market values. Even in this country, Americans are selling nearly everything for lower prices than are necessary. Tremendous quantities of your electrical goods are coming into this country now, and all at too low values. The fancy ornamental poles demanded here for carrying overhead trolley wires cost so much to manufacture that a Britisher will not bother with them for less than £14 ((($68), but your people are bidding £10 ($48); why not ask £13, or, if you must sell low because you are nervously impatient, why not ask £12? Where municipalities demand that the poles be of British manufacture, it might be keen sport for the Americans to bid so low, knowing they cannot get the order. But when there is no such restriction and the order is yours, why take £10 when you can get more? If the same thing is going on all over the world, it is a warfare against reasonable trade and will react."

We have to look out, therefore, not only to sell all that we can, but to sell at the best prices we can, which it seems quite certain that we have not been doing, whether selling bolts and nuts or the various other products of our shops and factories. The unnecessary low prices abroad cannot fail to have a retroactive and damaging effect upon home prices, wages and other details of production, costs and selling values.

A Three-Spindle High-Speed Drill.

The half-tone shows quite clearly the principal features of a three-spindle, high-speed drill suitable for bicycle, sewing machine, typewriter or other small work. It was first designed to meet the special demands of the shop in which it was built. The countershaft at the back of the machine has a pair of tight and loose pulleys 8 inches diameter for a 2-inch belt, with a shipper in handy position for the operator. On this shaft are also three separate three-stepped cones, belting up to the three individual countershafts above, thus giving three independent speeds to each drill spindle. The drills are also fed independently by the usual vertical sleeve with pinion-operated rack. The spindles are balanced by an adjustable clock spring on the pinion shaft, and each spindle bracket is vertically and independently adjustable. The table, which is 26 inches by 16 inches, is also balanced and has a vertical movement of 22 inches, the movement of the spindle bracket being 10 inches, and the feed 4¾ inches. The



A THREE-SPINDLE, HIGH-SPEED DRILL.

table is clamped to the slide by a long gib and two eccentric cams operated by the handle seen below. This arrangement is found to keep the table truer than the split clamp so frequently employed for this purpose. Reversible bushings are provided for all the shaft bearings. The normal speeds of the drill spindles are 250, 500 and 1,000. The weight of the machine

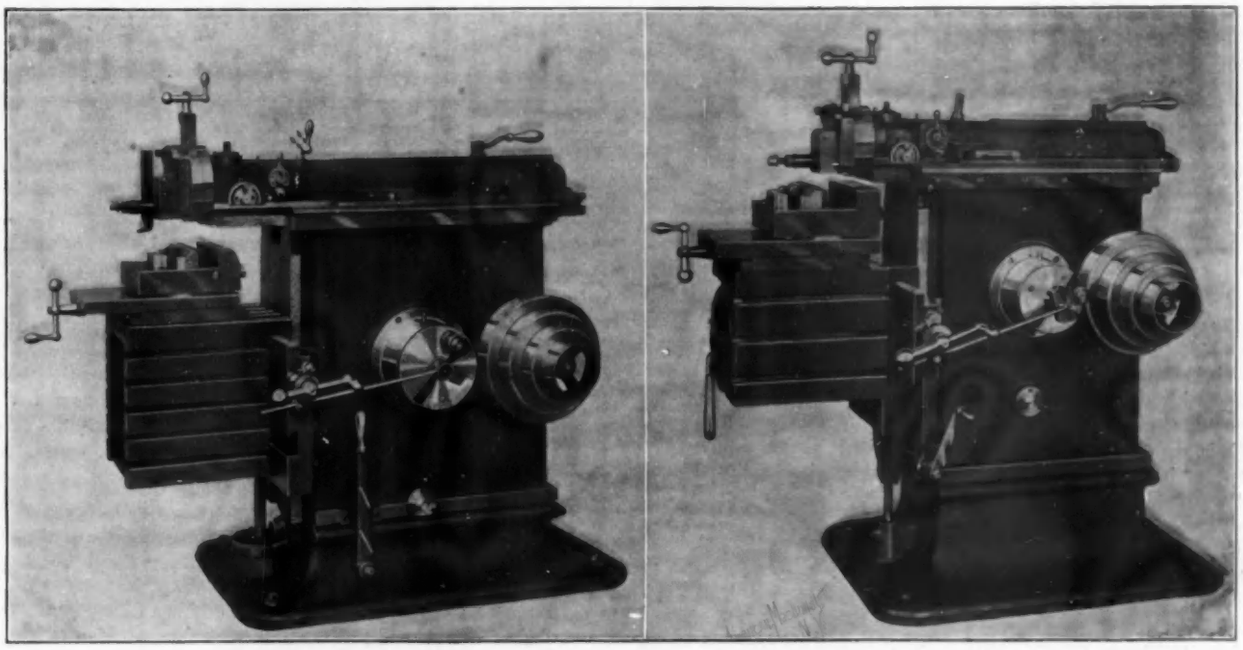
is 550 pounds. It is built, also single spindle drills of the same style, by The Fox Machine Company, Grand Rapids, Mich.

Two New Shaping Machines.

The accompanying half-tones show respectively a 15-inch and a 24-inch shaping machine, which are the product of the Potter & Johnston Company, of Pawtucket, R. I.

The stroke of the ram is adjustable to a graduated scale while the machine is in motion, and the tool has an automatic down feed which is adjustable in amount by the very neat device seen on the side of the ram. The change in feed is accomplished by locating the upper right-hand lever at the desired position on its arc and securing it there with the locking pin. The feed operates at any angle, ten changes being provided. With the arm in the extreme left-hand hole the feed is off. By suitably locating the stud in the circular arc at the left of the feed adjusting lever, the feed is automatically stopped at any desired depth. A peculiarity of this feeding mechanism is that while the position of the tool is positively locked at all times, as far as the automatic feed end is concerned, the tool may nevertheless be freely moved up or down by turning the hand crank.

The elevating screw rests on a ball step bearing to make the motion easier, and on the large-size machine the knee is raised and lowered by power. An additional feature of the small machine is a provision for rotating the knee about an axis parallel with the ram, whereby many angular cuts are obviously facilitated. A graduated circle and binding bolt for this movement will be seen at the left. A rotating and traversing vise with swivel jaw for taper pieces, and arranged to draw the work down to a bearing, is part of the machine's outfit.



24-INCH SHAPER. 15-INCH SHAPER.

A Design for a Small Welding Transformer.—I.

BY GEORGE T. HANCHETT.

When the mind of the machinist reverts to the hours of labor spent for the purpose of repairing gears or milling cutters by dove-tailing pieces of steel into their periphery and subsequently shaping them into teeth, he involuntarily sighs for a better method of fastening additional stock to finished work. His desire for such a device is by no means lessened when he calls to mind the countless pieces of work necessity has compelled him to discard because too much stock was taken off. He has perhaps been told that electric welding will help him out of such difficulties as these, but he has looked upon the process as mysterious and unattainable. It may therefore be welcome news to him to know that he cannot only become proficient in electric welding, but that he can easily build the necessary apparatus.

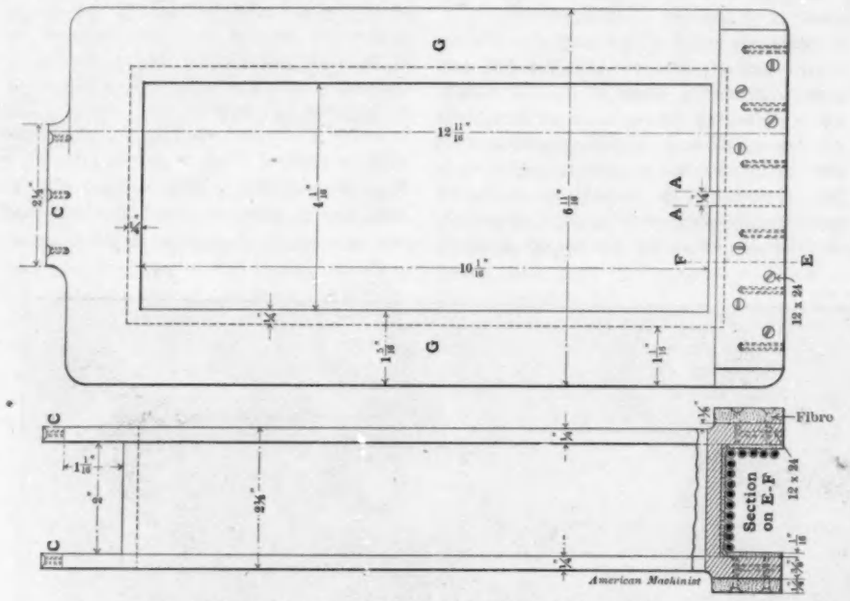
Besides welding, apparatus of this class can be advantageously applied to the heating of masses of metal for the purpose of brazing or soldering difficult joints or for drawing the colors on hardened tools. The source of heat can be accurately and absolutely controlled and the heat can be concentrated or distributed uniformly at will by proper manipulation. In brief, the variety of work which a machinist can perform is so largely increased by the addition of a welding transformer to his equipment, that the writer has ventured to believe that an illustrated description of a simple device of this class, which can be made from cheap materials with simple tools, will be appreciated.

The transformer described in the following paragraphs is intended to take about twenty amperes of current at 133 cycles per second at a pressure of 104 volts, and will deliver at its secondary terminals a current of 1,000 amperes at a pressure of nearly two volts. The primary is divided so that the apparatus may be worked from a 52-volt current, if that is desirable. This output will be sufficient to heat pieces of iron and steel not exceeding one-half inch in diameter to welding heat, and will generate sufficient heat in larger pieces for the purpose of soldering or brazing, and will draw the colors on still larger pieces of metal.

The transformer consists of two coils known as the primary and secondary. The secondary has but a single turn, which consists of a casting made of as pure copper as it is possible to obtain. Detail drawings of this member are shown in Figs. 1 and 2. The casting has a channel-shaped section, and when complete looks like a large magnet spool. It will be better to cast this member in a complete rectangle, as shown in the figure, and then to separate the ends by cutting out one-fourth of an inch with a hack saw, as shown by the dotted lines *A A*.

The terminals of the secondary coil are shown in Fig. 3 and consist of heavy copper castings which are bolted across the

flanges of the channel, one each side of the gap *A A* of Fig. 1. It is important that the joints be particularly well machined, for it is to be remembered that this part of the apparatus is traversed by currents of very low electric pressure, and the electrical resistance of joints in this circuit must be made a minimum by



FIGS. 1 AND 2. PRIMARY AND SECONDARY COILS.

perfect contact. The parts are all of copper, with the exception of some of the machine screws. The terminal at the left is the simpler. The casting of which it consists is merely a double-screw clamp, such as is frequently used on lathe carriages to secure the tools. The other terminal consists of a similar clamp mounted on the head of a T-shaped copper plate and is driven by the screw *S*. This screw is likely to carry large currents, and it is important that it should be of copper and as large as possible. At one end of the screw is brazed a collar which fits in a T-shaped notch in the end of the tongue *T*. It must be remembered that before this collar is brazed on the end of the screw the latter must be fitted into the nut in the end-plate, because after the screw is complete it cannot be withdrawn therefrom. The other end of the screw is machined square and provided with a movable crank, which is less likely to interfere with the work than if it were permanently fastened thereto. All

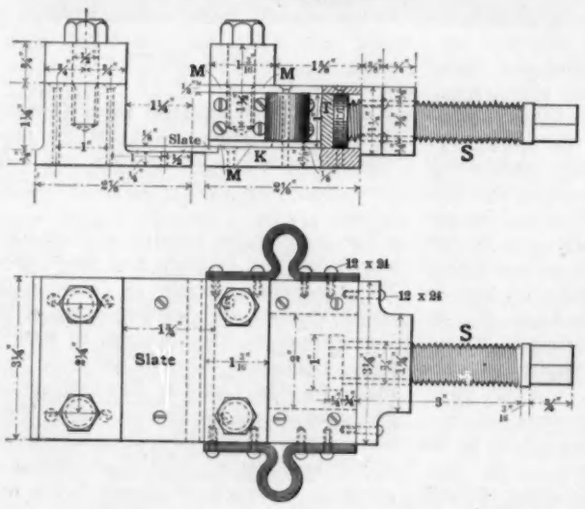


FIG. 3. DETAILS OF SCREW-DRIVEN TERMINALS.

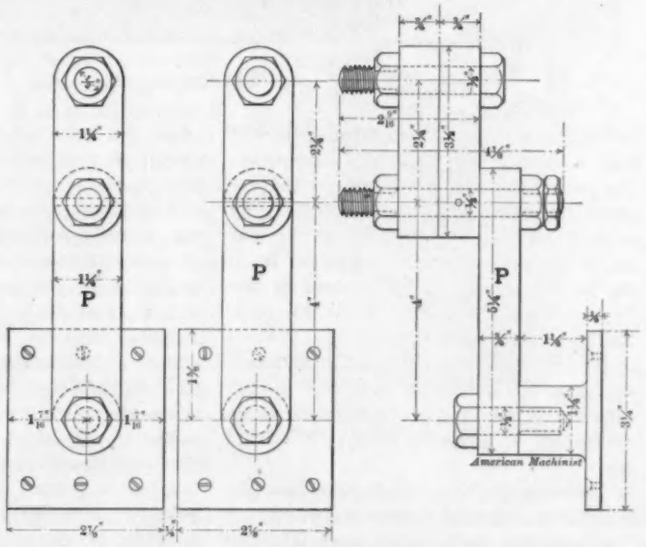


FIG. 4. SIMPLE CLAMP TERMINAL.

copper piece *M*, the tongue of which slides in a slot cast in the sub-base *K*, and is accurately machined to a fit. This member is confined in its groove by a of the other screws are of standard sizes and may be made of steel, although copper is preferable, especially for the clamping screws.

So important is it that good contact be maintained between the moving and stationary parts of these terminals that the contacts are reinforced by flexible connectors shown in the plan view. These may be of a sufficient number of leaves of thin copper built up to a thickness of five thirty-seconds of an inch and secured in place by four 12 x 24 machine screws. The details and dimensions will be apparent from the drawings, which are to scale.

As the terminal is projected forward by the screw, it slides upon a piece of slate, which is let into the base of the terminals, as shown in the figure, and secured thereto by two counter-sunk screws. Particular care must be taken that these screws be deeply countersunk and the holes tightly plugged with shellac. If there should be a contact between these screws and the terminal which slides over them, a short circuit would ensue, which would result in the destruction of the screws.

The terminals just described are very desirable though obtained at the expense of considerable machine tool work. For the benefit of those who desire something simpler the terminals illustrated in Fig. 4 are described. These are alike and may be made of copper castings with no more expensive tools than a file, some taps and a few drills. A round pedestal is cast on each of the flat plates which are screwed across the flanges of the channel bar and to each is bolted a short copper bar *P*, carrying at its extremity a double screw clamp. The screw fastening this clamp to the bar *P* should be of copper, for it is an important part of the circuit of the transformer. It is secured into the first section of the double clamp by a pin, and on the other side of the bar are placed two check nuts, as shown in the figure. This joint must be kept tight, and as it works loose from time to time the check

nuts must be tightened to take up the play.

The clamps are fastened to the arms that carry them by one screw only, and therefore can be moved on that point as a pivot. This motion, combined with the pivotal motion of the arm, renders the possible movement of the parts to be welded such as to enable good work to be done by skillful hands.

It will be readily seen that the jaws described as suitable for the secondary terminals have only a general utility, and the machinist will find that other devices can be made for holding special work which can themselves be held in these master jaws and which will be better adapted. These appliances may be of any form that his ingenuity may devise, it being only necessary to remember that they must make firm electric contact with the terminals on which they are mounted and must be preferably of copper to diminish the contact resistance. The workman will find that the heat concentrates at a poor contact, and he must endeavor to make this contact the point to be heated, whether it be a job of welding, brazing or soldering.

It will be seen at once that if screw driven clamps are used the pressure which they are capable of exerting would tend to spread the casting which forms the secondary. For this reason and also to give the structure additional strength during the process of winding two plates of hard fibre are securely screwed across the gaps between the lines *A A*, as shown in Fig. 1.

When the terminals have been completed and fitted to their places on the ends of the secondary casting, they must be removed for the time being in order to permit the winding up of the primary. Before this is done the channel of the secondary is lined with insulation which is best made of shellacked fiber. Sheet fiber one-sixteenth of an inch in thickness should be soaked in alcohol till it is flexible and then thoroughly shellacked and bound into the grooves in the secondary casting by means of blocks of wood. The corners where these fiber troughs meet should be carefully butted together, the insulation being trimmed with a sharp knife. These cracks at the corner should be reinforced by slipping in a thickness of mica between the fiber and flanges of the channel. Thus prepared the secondary casting should be placed in a hot oven and baked until the shellac is perfectly hard and dry, when the wooden blocks may be removed and the insulation will be found to retain its form, and to strongly adhere to the casting. In order to secure the insulation still further before winding, the casting should be bolted against the face-plate of a lathe by means of a block of wood and bolt passing through the head stock spindle, and two layers of cotton cloth well soaked in shellac should be tightly wound on. The primary wire is wound in the groove thus prepared for it, and it lies therein in the manner shown in the section of Fig. 2. It consists of two copper wires, No. 6, Brown & Sharpe gage, which are wound side by side. The inside terminals of these wires are somewhat difficult to bring out of the coil in a satisfactory manner. In order that they shall occupy as little space as possible in passing by the other layers, they are made of sheet copper, which is soldered on the ends of the wire, as shown in Fig. 5. A slip of mica, of the same size as these slips of sheet copper, is placed on either side thereof and bound in position with adhesive tape, which also serves to cover up the exposed ends at their junction with the wire. It will be found best to arrange these terminals side by side, because if placed immediately adjacent to each other, they will take up too much room and moreover much enhance the danger of short circuit between them. The two wires are now wound on together from two separate reels, there being exactly 25 turns of the double wire, which will make five layers of ten turns in all. Between each layer is placed a sheet of shellacked cotton cloth as the winding proceeds, and care must be taken to protect the thin copper terminals of the inside ends by a sheet of mica which separates them from the wires by which they pass.

When the winding is complete, the two ends of the coils are conveniently secured by strong strings tied to the adjacent turns. These strings are laid in position before the last two turns are wound on, and are tightly knotted when the winding is complete. The primary winding should be started and should end at the lugs *C* (Figs. 1 and 2). A bridge of stiff fiber should be made and bolted across the flanges of the secondary casting at this point, as shown in Fig. 6, and on this piece are to be mounted four binding screws. These screws may be bought of any electrical supply house, of any size and shape desired. Two of these screws are connected to the thin copper strips brought out from the inside ends, and the other two are similarly connected to the outer ends. This work completes both primary and secondary windings. The parts of the secondary casting that carry no terminals must now be insulated with two layers of adhesive tape, wound round and round so as to cover them up.

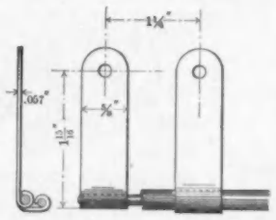


FIG. 5. PRIMARY WIRE CONNECTORS.

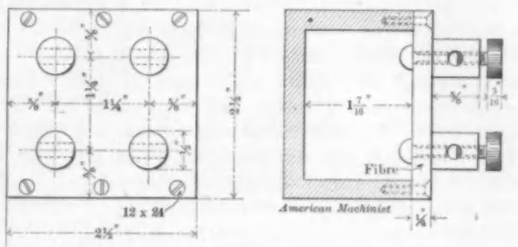


FIG. 6. PRIMARY WIRE TERMINALS.

Letters from Practical Men.

Training at Fault.

Editor American Machinist:

It seems to me that "Superintendent" takes a very pessimistic view of the average machinist in your issue of December 29. There are, to be sure, in most shops many hands of the class he mentions, those who turn out as little work as possible consistent with holding their places, but is the fault theirs as much as that of their training? Nine-tenths of them entered the shop as boys from fourteen to eighteen years of age, beginning with a small day wage. Soon after entering, the would-be machinist is given a simple job on probably the most ancient machine in the shop; the time-honored squaring up nuts, tapping or drilling out blanks. Perhaps a little later he is allowed to rough out some bolts or do some jig drilling. The tool he uses has very likely been sharpened for him or under the direction of the man in whose care he is placed, and is cutting nicely. For the first few days he is full of enthusiasm and likes to see his pile of nuts growing, and tries to reduce the time necessary for each one. Soon, however, he makes a discovery, in fact several. He finds that rapid work is more tiring than slower work, that by using the ancient fine feed to the machine he saves both himself and the point of the tool, which he dislikes to grind, as it does not cut as well as when his "boss" does the grinding. He finds that when he attempts to take heavy cuts the belt slips or the tool chatters, and above all he finds that he gets no credit for the fifty or so nuts he has completed per day more than he did at first, and so, like the rest of the "gang," he decides to take it easy.

Now this seems to me to be all wrong. There are few shops in which the work at which an apprentice is first put has not been done for a time long enough for the cost to be closely known. Give him a price for every additional piece above a specified number, a price low enough not to need lowering if he does well. This money to be additional to his day's pay. Then let him go at it. This done, he be-

gins to see that it is to his advantage to do his best, and to work hard both himself and the machine. But you say, "any man knows that it is to his advantage to do his best." So he does, but few realize it, and immediate profits are a much greater spur than distant ones. Give the boy a good machine, one that will stand a heavy cut. Teach him to drive it hard, to use it, but not to abuse it. Keep the belts tight. Give him an extra tool, that he may always have a sharp one at hand, and if he breaks one once in a while, not through carelessness, do not give him a "calling down" for it.

A good superintendent should see distant profits as clearly as those close at hand. Then by giving immediate profit to those not gifted as he is, the ultimate profit will be his in greater production per man, per machine, per area of floor space or whatever his unit of producing capacity may be. R. W. G.

Boston, Mass.

Superintendent at Fault.

Editor American Machinist:

In the article by "Superintendent" under date of December 24, he states some palpable truths regarding machinists but seems incapable of suggesting a remedy.

Although I am only a machinist I would like to offer a few observations respecting machinists who manage machines badly and superintendents and foremen who manage machinists and machine shops badly. That narrow, slow-running feed belt business I am glad to see some makers are leaving out of their designs. But the slow and narrow machinists and managers will be with us I fear for a long time yet.

Did "Superintendent" ever wonder why machinists seem to cling to the slow feed business? Perhaps the shop heart was not pulsating properly.

Machinists of liberal proportions are not so scarce. I have met many whom I would class as superior men, whose services any shop might feel honored to repay. But machinists of "Superintendent's" class are more numerous though the management of many shops has little effect for the better on a subjective mind.

In my experience I have noticed with pain how little good will existed between machinists and foremen. Each blame the other for their own shortcomings, and the slow feed machinist is always in the narrow minded shop.

Machinists, I think, too, are worked too hard; ten hours per day of constant application is too much for anyone where such a degree of exactness is required. Sharp competition makes necessary the utmost efforts of managers and men, and the physical well being is entirely ignored, and as it requires considerable bodily strength to push a machine to its utmost, can it be wondered why we use the slow feed? And again there is the ambition that goes unappreciated and unacknowledged. Few broad tool machinists there are whose endeavors would not be accelerated by a "thank you" and a "good morning," and as to following up and nagging, nothing could be more detestable or more serious in retarding a machinist's output. I always make my stay short with that kind of foreman.

I hope I shall yet meet "Superintendent." Modern tools make me smile, and I shall be satisfied and I would endeavor that he should be satisfied.

ONE OF CHORDAL'S DISCIPLES.

The Taper of Pipe Threads.

Editor American Machinist:

In your answer to "M. H." you say that the proper taper for pipe taps is three-quarters of an inch to the foot. This is all right if it means the standard, but all wrong if it means the best way to get tight and easy joints. The pipe tap should have a greater taper than the threading die. Just how much greater may be a matter of choice, but one inch taper for the top and three-quarters for the die is good enough in practice and avoids all necessity for stuffing boxes, red paint or other dope. The reason is easy to see. If the pipe has the less taper the joint makes up at the end of the pipe first, as it should do, and that point being tight all the rest must be tight too. With moderate screwing up the pipe end becomes smaller and is ready to expand with the pressure, while the fitting becoming larger is already under tension to prevent further expansion. With a difference of one-quarter of an inch in the tapers a hydraulic pipe will readily fit the whole distance the thread is screwed in. The joints so made are good for pressures up to 10,000 pounds and can be taken apart and put together indefinitely. Oil that is good enough for the die is good enough for the joint, and no dope is of any value.

SUPERANNUATED.

More Whims.

Editor American Machinist:

The subject of "Whims," treated of in the "American Machinist" recently by Mr. Bullock, is a prolific one and deserving of a more profuse illustration. Among whims none are more absurd than that of the short stroke engine. By common consent of the buyer and builder the stroke of engines has become absurdly short, to the advantage of the former and the disadvantage of the latter. In some of the worst cases the travel of the crank pin ranges within the diameter of the shaft during almost the greater part of the revolution, entailing an unnecessary friction in pounding the shaft. Besides, so many more revolutions have to be made for a given power that the clearance amounts to an inordinate per cent. of the cylinder capacity.

The gain for this sacrifice is had in smooth running, and in some cases higher rotative speed. High speeds have come to be a necessity, but short strokes are not. Probably the best proportion in an engine is that in which the stroke is double the diameter of the cylinder. The highest speeds ever attained in regular practice was with engines 7 inches in diameter by 17 inches stroke, running 450 revolutions per minute, built by Sharpe, Davis & Bonsall, now the Buckeye Engine Company, during the fifties. These were long strokes and high speeds as well. They had an extensive sale, and I can vouch for their smooth running and general excellence for those times.

Other shops have made 12x24 engines that run 225 revolutions per minute with entire satisfaction. The ideal proportion is a long stroke and a high speed combined.

Another fashionable vagary is that of hauling engines advertised as "haulage engines." If haulage why not hoistage engines? However, it is a curious fact that the word "hauling" is not found in the dictionaries except as it is used to describe other words, and after all this whim is probably the result of a blunder of the dictionary maker.

The "American Machinist's" way of spelling the word "catalogue" is a vagary in which no harm is done, but if the word must be bobtailed why not make it simply "log"?

A whim in machine construction implies something that is believed to be useful, but is frequently quite the reverse. The friction clutch overhead pulleys used on lathes are an instance. Bored guides for engine crossheads are probably used for the sake of variety, certainly not for their convenience of access. Solid ended connecting rods are used in many shops apparently because the Pennsylvania Railroad set the example.

Brazil, Ind. C. W. CRAWFORD.

Business Cards.

Editor American Machinist:

The various sizes and styles of business cards make it exceedingly difficult to preserve them in a convenient form, and the consequence is that they generally find their way into the waste-basket in a short time after being presented. It is the practice of the writer to transcribe the information contained on a business card to an ordinary blank card, such as is used for filing in the cabinet of the American Library Bureau. By doing this, all addresses are easily preserved and the cards are filed under the name of the business instead of the name of the firm or individual presenting the card. This transferring of the record from the original card to the card in filing cabinet would be avoided if a uniform size and style of business card were adopted, and it would ap-

pear that it would be in the interest of all concerned if this could be accomplished.

The size of the standard card for filing in the cabinet mentioned is 3 x 5 inches, which is sufficiently large to permit all necessary matter to be printed thereon.

The sample card I send you shows the face of a plain business card with hole punched in proper place. The first line or heading denotes the business of the company offering the card, and this is used as an index for filing, under which system all cards would be filed under the title of the business or the article manufactured. This is done to secure a system of filing which will at all times furnish the information desired. As an example: There are a number of makers of car wheels. If the card was filed under the name of the individual presenting it, or the title of the manufacturer, the person seeking information from the card must remember at all times either the name of the individual or of the manufacturer, whereas if these cards were filed under the name of "Car Wheels," as indicated on the upper left-hand corner of the card, they would all be together in the file, and no effort of memory would be required. In this manner the name of the various supplies necessary to be purchased would be together in alphabetical order, and if it was desired to have a card under the name of the individual or the manufacturer, a separate drawer in cabinet could be used.

Each drawer will hold about 800 cards, and with this system we have a complete index of all firms manufacturing the various supplies, which is especially desirable for purchasing agents. Such a cabinet will not occupy a space of more than 6½ x 13½ on the desk.

The backs of the cards may be used for noting quotations, and will be found of great convenience in recording the visits of the representatives and quotations made at that time, and if such quotations cancel any previous figures, the old card will be removed from the cabinet and destroyed and a new card inserted in its place. I believe that a neatly printed card in this form will be of much greater value to all than the most expensive lithographed one which is not made in such a manner as to be preserved. The only catalogs which are sure to be kept and referred to are those which are made to conform to the standard size and if the purchasing agents of the railroads and other large corporations would request all business houses with whom they deal to furnish their representatives with a card made in the manner described. I believe that it will be but a short time before all business cards would conform to this principle.

CHARLES HANSEL.

A Type Dovetailing Job.

Editor American Machinist:

A number of years ago I did quite an interesting piece of work in the way of inserting some printers' type in the periphery of a tool steel wheel, about which some of your readers may wish to hear. The type to be used in this job were "self-spacing" type—that is, the width of each type body was a multiple of some unit, which in this particular case was one forty-eighth of an inch, six different widths being sufficient for the complete alphabet of capitals and small letters.

Fig. 1 is an enlarged view of a six-unit letter as it appeared when ready for insertion in the wheel rim. As all the slots in the wheel were alike, and just right for a six-unit letter, characters narrower than six units had to have a blank piece beside them to fill out with, as shown in Fig. 3, where "c" is a three-unit letter, with a three-unit space beside it. Of course all the narrow letters were thus thrown over to one side of the slot, but that was a necessary feature of the machine to which the wheel belonged. The capital "W" was the only letter that was seven units wide, and the extra unit overhung, all on one side.

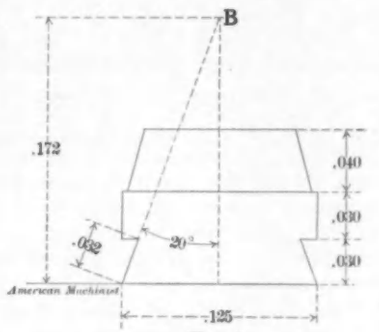


Fig. 1.

GETTING THE ANGLES AND LOCATION OF DOVETAIL.

Figs. 2 and 3 show the method of milling the dovetail slots in the wheel rim, using a cutter of any convenient diameter, and with teeth coarse enough to be ground on a cutter grinder. The cutter had teeth on the 20° bevel edge and also on the flat face *A*. The part containing the teeth was a little narrower than the narrow part of the slot to be cut, while the body of the cutter was left thick to give it some substance and make it warp less when hardened. The cutter was first set away from the center line the proper amount and 40 slots were cut in the wheel as shown, with some of the slots cut, in Fig. 2. Then the cutter was reversed on the arbor, set off the other side of the center, and the slots finished, as shown in Fig. 3.

The distance to set the cutter off the center was found thus. Referring to Fig. 1, we see that the finished bit of type-metal was to be .100 inch high, and .125 inch wide at base of dovetail. By dividing .0625 by the tangent of 20°, we get .172 inch as the distance from base up to point *B*. Subtracting from this the hight of the type, we find the point *B* is .072 inch outside the face of the letter. The finished diameter of the wheel, measured from face to face of letters, was to be 2¼ inches, so 1.125 + .072 = 1.197, which was the distance of *B* from center of wheel. Knowing *B D* (Fig. 2), we can multiply it by the sine of 20° to get *D E*, which was found to be .409 inch, the distance to set the flat face of the cutter off the center. A good way to set a cutter of this kind a certain distance off center is to put a small true arbor of known diameter between the centers, bring it in contact with the side face of the milling cutter, then move the cross slide .409 inch plus half the diameter of the arbor used. The setting for each side of the center was first determined, and a record made of the readings of cross-feed dial before commencing to cut into the wheel blank. After the cutter was set properly off center, the knee was raised till cutter just touched wheel rim, and after this raised .032 inch more for depth of cut. As the depth was, in this instance, to be measured along the slope of the dovetail, we divide .030, the real depth in a radial direction, by cosine of 20°, which gives the .032 inch we are after. The wheel was indexed for forty slots, and after cutting them, and shifting cutter to position shown in Fig. 3, it was necessary to index the work around a little to bring the partly formed slots into proper relation to the cutter. As the first cuts were taken at 20° to the left of the vertical center line, and the second cuts 20° to the right of it, the work was indexed through 40°, or four and four-ninths turns on B. & S. index head, be-

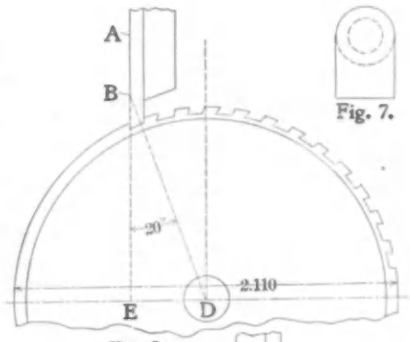


Fig. 2.

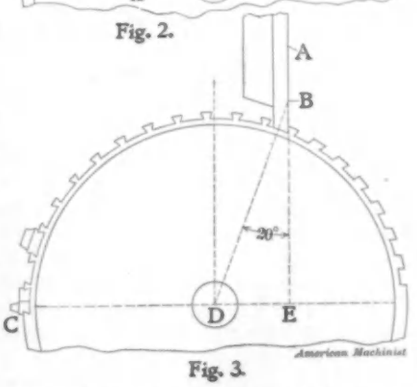


Fig. 3.

SETTING THE CUTTER FOR MILLING THE TYPE.

Fig. 7.

fore commencing the cutting shown in Fig. 3.

Figs. 4, 5 and 6 show the method of nicking the types and cutting them off. *F* is a brass or cast iron bar, long enough to hold in the milling machine vise and project over the side to enable operator to manipulate nut *G*. The bar had a groove *H* milled in its top face, slightly less than ⅛ inch deep, and .152 inch wide, which was the thickness of all the type. A steel piece *K* formed an end stop, against which to abut the face of the letter, but it swiveled stiffly under the head of shouldered screw *L*, so that it could be turned down out of the way during the cutting off operation shown in Fig. 6. The type were held in the groove during cutting, by bolt *M*, a plan view of the head of which is shown in Fig. 7. The nut *G* drew this bolt down, and when released about a half turn, the spiral spring threw it up, when it could be turned around in its socket, to allow of removing the type body from groove. Fig. 4 shows a four-unit type in the groove with a two-unit space under it to bring it to proper hight for nick to be cut. Fig. 5 shows the same pieces turned over—the four-unit type on the bottom and two-unit space on top. After the two opposite nicks were cut, the knee was dropped and the saddle was moved crosswise, to bring the work in proper relation to the circular saw *N* on the same arbor with the bevel cutter *P*. In my first attempts, the piece *K* was fixed, but I found that just as the cutting off operation was finished the face of the letter, especially if narrow, got damaged by being jammed diagonally between the circular saw and *K*, so I made *K* to swivel, as shown in Fig. 6, that it might be turned out of the way for the last operation.

The method of getting the settings of the machine, as shown in Figs. 4, 5 and 6, is quite simple. I began with the last end first, and monkeyed with the cross slide till I could cut off a type just .100 inch high, without any nicks in it. That gave me the cross slide setting for Fig. 6, of which I made a record. Then by setting the machine, as in Fig. 5, only a little deeper, and without any type in place, a steel wire .070 inch diameter, or a flat piece of sheet metal of that thickness, was inserted between the flat face of the cutter *P* and the inside face of *K*, the arbor being at rest, when the cross slide was moved till this distance piece would just hang by friction, and a record of cross feed dial was then made.

As to the vertical adjustment in Figs. 4 and 5, that was a matter of cut and try. There were plenty of type to spare in the font we had, so those were used to experiment with, gradually altering the vertical adjustment of the knee in Figs. 4 and 5, till a six-unit type could be nicked and cut off, and fit properly in the slot in the wheel. The type were held in the slots of the wheel by friction only, being started in with the fingers and forced home by grasping the wheel rim with partly inserted type, between the jaws of a pair of parallel pliers. If the cut in Figs. 4 and 5 was too deep, of course the type would be loose in the slots. If not deep enough, then the steel slot would act as a shaving die, and take some more off the type as it went in, and then it would not be very tight, and would also be displaced a little from its true position.

As there was so little margin on the fit, it was deemed advisable to insert each type in its place as it was cut off, and if not a proper fit, throw it away and mill another with the knee higher or lower, as the case called for. Under the circumstances it became necessary to use two cutters on one arbor, not as a gang mill, but for two distinct operations. This idea of using two cutters on one arbor was not original with me, as I had seen it used before on a stock ticker job.

I think the method of slotting, shown in Figs. 2 and 3, is superior to using a butt mill, as it gives greater durability to the cutter. On the other hand, the method I show would produce slots of different widths should there be any irregularity in the indexing head, from which objection the butt mill method would be free; still the increased wear of the butt mill would more than offset this possible source of error, so I am inclined to think that the method shown is the better way.

The first wheels that I slotted, as shown in Figs. 2 and 3, were done about eleven years ago, the type being electros, and wide enough so that only a single piece went in each slot, but the operations shown in Figs. 4, 5 and 6 are of a somewhat later growth.

WALTER GRIBBEN.

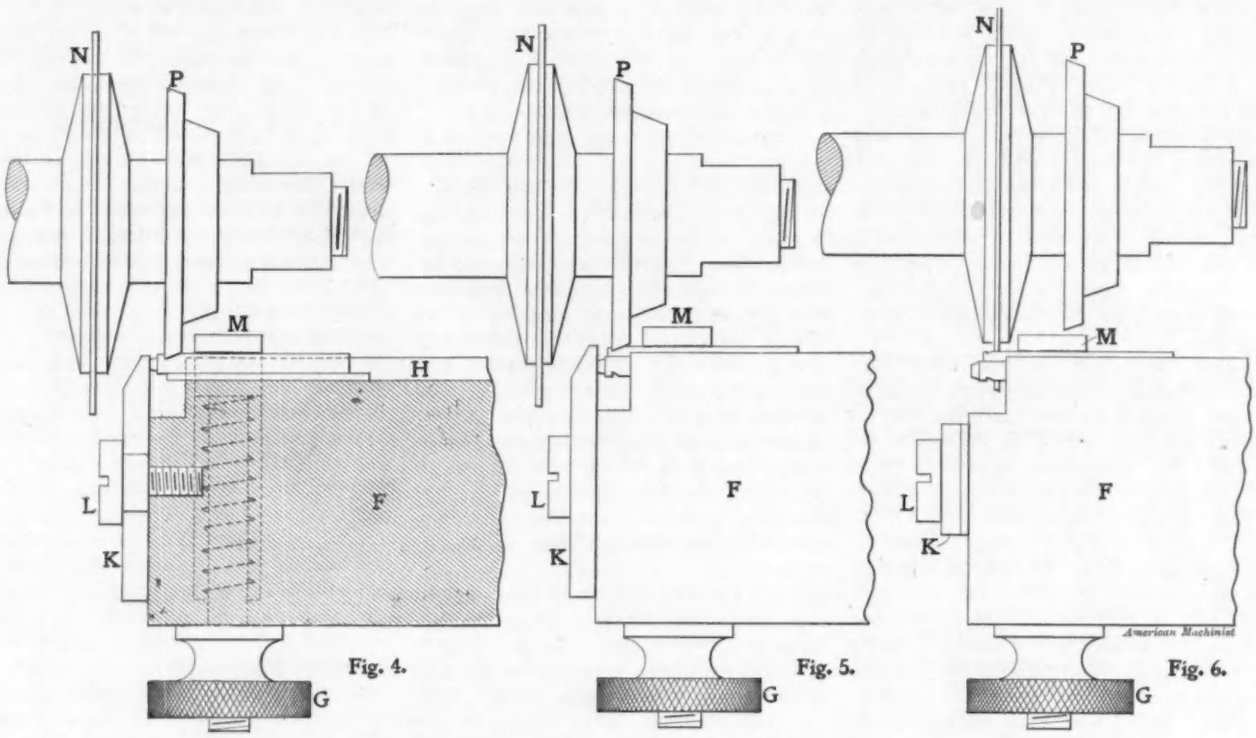


Fig. 4. Fig. 5. Fig. 6.

MILLING DOVETAILS AND CUTTING OFF THE TYPE.

The Rotary Blower as an Air Compressor.

Editor American Machinist:

The article on "The Rotary Blower as an Air Compressor," by Mr. Frank Richards, in your issue of December 29, 1898, was read with much interest, because I have been for some time making a line of such blowers and repairing those made by others. The drawings herewith will, I think, show that some of his criticisms do not apply to this kind.

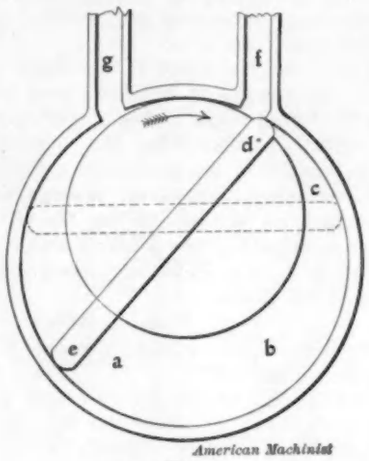


Fig. 1

A SIMPLE TYPE OF ROTARY BLOWER.

I believe, with him, that 5 lbs. pressure is the limit that should be used, if the blower is to run continuously. Even at this pressure the cylinder becomes quite hot, and thereby reduces the amount of free air the blower will deliver per rotation. At least one concern makes a blower with a water jacket around the cylinder, and they guarantee it up to 20 lbs. pressure. I would think that the leakage would be very objectionable at that pressure.

The statements to which I take particular exceptions are as follows: "Now, although the tripping open of the delivery valve at the beginning of the compression stroke would be, as was remarked, an absurd thing to do, and would also require more or less ingenuity, or at least a considerable going out of the way to accomplish, it is precisely the thing which actually occurs in the rotary pressure blower." And again, after correctly explaining part of the action of the blower which he describes (and I must say a worse design could hardly have been selected) he goes on to say: "Practically the same thing occurs with the duplex or two-impeller blowers, and with *all* the machines of the rotary type without actual valves for retaining the air when once delivered."

Let us note some conditions which are present in the operation of such a blower as his Fig. 2. In Fig. 1 of this article (which is the same as his Fig. 2, except in the position of the impeller) the end *d* of impeller is shown where it has just passed the inlet port *f*. The space *a b c* is now filled with air at atmospheric pressure. Now turn the piston until the impeller is in a horizontal position, and it will be seen that the area of *a b c* has been increased, thus expanding the air.

When the piston is turned so that the end *e* of the impeller is about to pass the left side of the discharge opening *g*, the confined air is again brought to atmospheric pressure. Then on the farther turning of the piston there follows the return of air from the discharge pipe, as explained by Mr. Richards, and some of the work of compression has to be done over again.

In addition to the above, as the end *e* of the impeller passes from the right-hand side of the discharge opening *g* to a vertical position, it compresses the air ahead of it considerably if the blower is properly fitted up. This work is all lost and the wear of bearings, etc., increased.

Let us now look at a cross section through a cylinder, piston and impellers of another design of rotary blower (see Fig. 2). The piston is against the right-hand side of the cylinder. The air enters through the port *f* at the bottom. It then passes to the left, filling space *a*, *b*, *c*. As the piston rotates, the impeller *d* passes the left-hand edge of port *f*, thus confining the air. This occurs when the impellers *d* and *e* are equidistant from the center line *h*, as shown, and when the area included between them is the greatest. As the piston continues to rotate, the area of this space is reduced, and when impeller *e* passes the discharge opening *g*

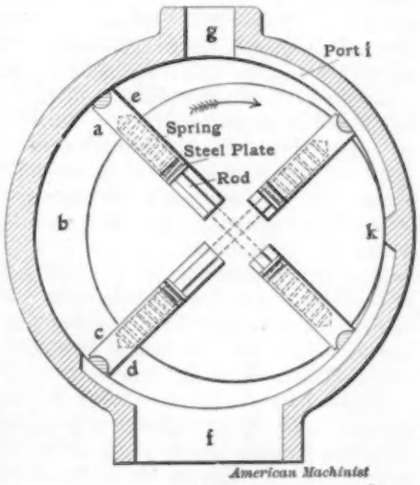


Fig. 2

VERTICAL SECTION OF IMPROVED BLOWER.

the pressure between the impellers has risen to that in the discharge pipe, and no return of air takes place. This is easily arranged for when the desired pressure is known before the blower is made. In my trade I find that 2½ to 3 pounds is about the average pressure used. After the impeller passes the discharge opening, the air between it and the point of contact *k* between piston and cylinder passes back over the impeller through the port *i*. The upper right-hand edge of port *f* is near the point of contact spoken of above, and is for the purpose of preventing a partial vacuum behind the impeller after it has passed the point of contact *k*. I think the above effectually disproves the statement that all rotary blowers have to do the work of compression over and over again.

Let us now take up the question of the shape of the cylinder bore. By the way, is it a cylinder if it is not round? Should it be round, or should it be of such shape that a blade of fixed length will fit at any part of its revolution?

With the round cylinder, light springs keep the impeller shoes always in contact with the surface of the cylinder, and if they are properly designed and fitted, there is absolutely no leakage past them except at the ends, and practically none there if they are a good fit. I have yet to see a well-designed impeller shoe which is worn enough to affect its working. Some makers put a semicircular shoe in a V-slot, but they wear hollows in the back of the shoes.

I have frequently run these blowers at 15 pounds pressure for a short time, but they soon get too hot to work well. The rotary blower is an interesting machine to study, and, although simple in appearance, it requires considerable experience and a first-class job of machine work to make a good one. I found this out very promptly when I commenced the manufacture of them. For pressure up to 5 pounds I believe they are by far the better type of machine, as they have no valves to give out and leak, and all moving parts are positive in their action.

WM. HOLLINGSWORTH.

Baltimore, Md.

For Lifting the Planer Tool.

Editor American Machinist:

Reading Mr. Perrigo's article on a tool protector in the last "American Machinist," calls to mind a similar device which I have seen used here, and which has the advantage of being procurable at any hardware store for a few cents, in case it cannot be found in the junk pile. It is simply a strap hinge of the barn-door variety, with a loose joint, and if necessary a piece of iron to weight the free end. It was arranged in exactly the same manner as Mr. Perrigo's device, being clamped behind the cutting tool.

E. R. PLAISTED.

Montpelier, Vt.

Can We Feed a Boiler for Nothing?

Editor American Machinist:

J. W. A., in your issue of Jan. 5, says I did not complete the cycle of operations in my method of "feeding a boiler for nothing," as I started with the tank full of air and left it full of steam, and

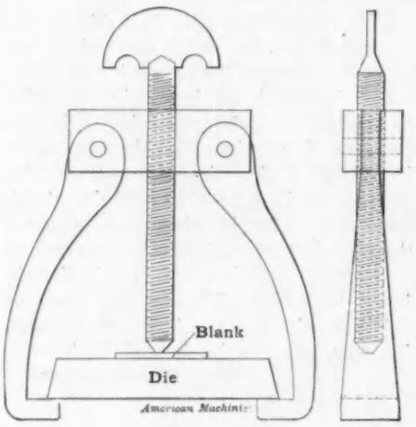
asks: "How could he again get water or air into the tank without losing the steam there?" We would never want to get air into the tank, but to get water in all that would be necessary would be to open the water valve. The steam would be condensed, and thus in one sense it would be lost, but it would give up its heat to the water, which would enter the boiler, and thus no heat would be lost. The cycle is complete the second time the tank is filled with water. W. K.

A Handy Clamp.

Editor American Machinist:

The reading of Mr. Painter's article on die construction has brought to my mind a clamp which I have used to do away with making the template after the master blank is made. First I find the exact center of my stock for the die, then having placed the blank on the center, or the place where I wish the die made, I clamp it very securely and mark out the die by the blank.

This clamp may also be used to hold the blank steel for the punch tightly against



the die, making a very easy and accurate way, as the work can be turned to the light, and the inside carefully examined. The accompanying sketch will give an idea of the construction of the clamp. It is probably old to many of the readers, but never having seen it in print, I thought it might be of interest. READER.

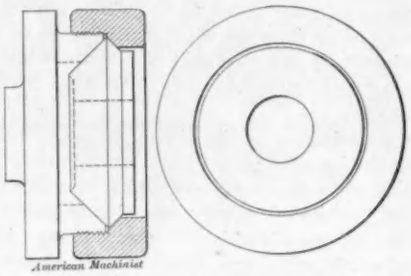
[The clamp is evidently a serviceable one for many purposes besides that above referred to.—Ed.]

Chucking Small Bevel Gears.

Editor American Machinist:

I have learned so much from "Letters from Practical Men" that I thought perhaps a sketch of the chuck herewith might be of benefit to somebody. It is often a slow and somewhat difficult operation to secure in the lathe chuck for boring, bevel wheels, bevel wheel blanks, bevel friction wheels, or similar pieces having angular faces and little or no holes. The sketch shows a cheap but effective arrangement for holding such work. It is neither new nor original, but has been entirely satisfactory for the work for which it is designed.

The main piece *A* may have a flat back to bolt to a face plate, or it may have a hub on it with a thread cut in it to screw right on to the spindle as shown. On the front of it is a projecting ring *B*, with its face beveled to fit the wheel and the outside threaded for the nut or cap *C*. This cap is beveled at *E* to fit the back of the



CHUCK FOR SMALL BEVEL WHEELS.

gear, and when it is screwed up the gear is brought true and is held securely for boring. It of course will not pay to make the chuck if only two or three gears are to be bored. S.

For Improving Blank Forms, Catalogs, etc.

Editor American Machinist:

The method of keeping and correcting samples of office stationery as practiced at Lane & Bodley's and described in a recent number of the "American Machinist," is admirable, particularly in evolving instructions for setting up and operating machinery. Experience shows that such circulars or pamphlets are constantly being added to when found incomplete and modified where misunderstood. In addition to the methods described by you, let me suggest four more things for the consideration of those machine builders who are seeking to systematize office methods:

(1) Assign a form number to every different piece of printed matter used.

(2) Keep conveniently before you a list of these form numbers, together with the numbers of photographs or blueprints frequently sent out, as foundation plans and pictures of standard machines are.

(3) In the file mentioned place a sample of latest issue of each form, with notations for improvements in future issues and a pencil memorandum of printer's name, date and number ordered and the price paid or quoted on same.

(4) In dictation give the stenographer the form number of all enclosures referred to, this form number to be typewritten at the bottom of sheet.

The last is the strongest feature of the whole system, because of most constant use and benefit. Two-thirds of a machine manufacturer's outgoing mail contains several enclosures or refers to something which ought to accompany letter. It may be a proposal, price-list, bulletin or facsimile or that good testimonial which Crackitup gave you. Whatever it may be, if the proper number is given at the foot of the letter, the person making up mail can rapidly check off and enclose what is called for without reading the whole letter to sense the situation, as would be required if the foot-note said "Two enclosures," a common practice.

The net result is a saving in time, in postage and a clincher on getting the whole case before the prospective customer in the first letter.

The writer has found it convenient to index the samples of stationery used under their form numbers, five in a division, or 125 in a common letter file. This file then becomes of great value in checking printers' bills or pricing an inventory of stationery, as well as fulfilling the functions mentioned in the previous article.

Enclosed are a few of our forms illustrating the system.

ROBT. S. BROWN,
Secy. New Britain (Conn.) Machine Co.
(30, 40, 48 & 50)

[At the foot of Mr. Brown's letter the numbers appear as above, and have been checked by the person inclosing the various blanks, and the blanks are all in. We know from our own experience and observation that this communication contains ideas the general adoption of which would do much to avoid misunderstandings and unnecessary delays in the transaction of business. System and order are as valuable in office work as in the shop, and the above communication contains, in our opinion, valuable ideas which are evidently based upon actual experience.—Ed.]

Speed Regulation of Electric Motors.

ALLAN D. ADAMS.

The growing tendency to direct-connect electric motors and machine tools renders the problems arising in these combinations of interest at this time, one of the most important points being that of speed regulation.

With belt or other flexible connections between the motor and driven machine, the motor speed may be constant where the speed of the machine is varied by intermediate devices; but when gears are used for connection, or the motor armature is mounted on a spindle of the driven machine, all speed changes must originate in the motor, and these last are the cases to be considered.

It is worthy of note that the electric car and the electric elevator both employed a flexible connection with the motor in the early stages of development, but have since resorted entirely to geared connections, and it seems probable that the same course will be followed as to electrically driven machinery of other kinds.

The normal speed of motors, when not influenced by external regulation, is

one of the first points to be decided in a case of direct connection. Proper normal speed for a given case cannot be decided until a method of regulation for speed is selected, as a normal speed necessary with one means of regulation would not be desirable with another.

Within working limits the speed of an electric motor varies directly with the pressure or volts at the armature terminals, the magnetizing power of field coils being constant; if the pressure of the armature terminals is constant with varying magnetizing power of its field coils, the speed varies inversely with the magnetizing power. Electric current is distributed to motors at a constant line voltage or pressure, in nearly every case, so that changes of volts at motor terminals must, if required, be effected by special devices at each motor.

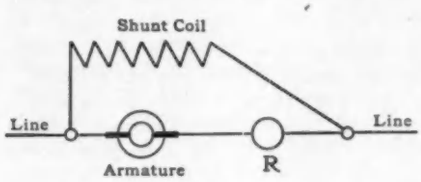


Fig. 1

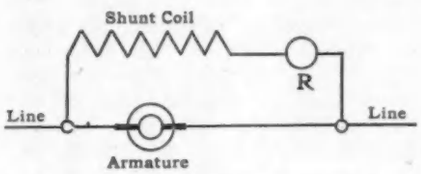


Fig. 2

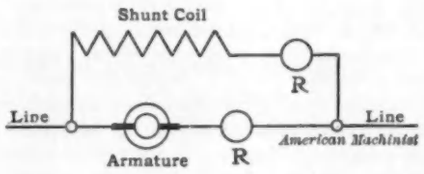


Fig. 3

SPEED REGULATION OF ELECTRIC MOTORS.

The speed of electric cars is now much regulated by the use of two motors to each car, and devices which connect these motors in what is known as in series or in parallel with each other according to the speed desired. Similar results to the last named may be had by the use of a specially constructed motor having two windings on its armature and two commutators, so that these two windings may be connected in series or parallel with each other. In machine tool driving, however, the power required in single units is too small and the necessity for simplicity too great to permit either of the last-named methods. Having then a constant line pressure and a single, simple motor to drive each machine, speed may be regulated by devices which either vary the pressure at armature terminals or change the magnetizing power of field coils.

Owing to lack of uniformity in speed at varying loads and other causes, the series winding is less suited to machine driving than the shunt winding, in most cases, and the shunt winding will therefore be considered in what follows. If speed regulation is effected entirely by variation of volts at armature terminals, the normal speed of motor, with regulator out of use, will be sufficient to give the driven machine its greatest required speed, and lower speeds will be attained by the introduction of a variable resistance or rheostat in the armature circuit, as indicated in Fig. 1. The rheostat *R* in this case has flowing through it the entire armature current, and consumes power in proportion to this current and the volts between its terminals. When the speed of motor has been reduced one-half, the volts between rheostat terminals will nearly equal that at armature terminals, so that nearly one-half the power taken from the line will be wasted in the rheostat as heat, the remaining half going into the motor. In this method of regulation the efficiency of operation is high only at the maximum speed of motor and drops rapidly as speed decreases.

The next case is that in which speed regulation depends entirely on variation in the magnetizing power of the field winding, and the normal speed of motor gives the driven machine its lowest required speed. With this arrangement speeds are attained by the use of a rheostat in the shunt field circuit, as shown in Fig. 2. The shunt field winding of a motor takes but a small percentage of the rated power, usually from 2 to 6 per cent., and this power is independent of the load on motor, being fixed by the resistance of shunt winding and its rheostat.

When the resistance of rheostat increases, the current flowing through the rheostat and shunt winding decreases, the magnetizing power of the shunt therefore decreases and the armature speed increases. At the point where the speed has doubled, the power consumed in the shunt winding and rheostat combined is only about one-half of the 2 to 6 per cent. consumed in shunt winding at the lowest armature speed, but as friction and iron losses in the motor increase slightly with the speed, they about offset the gain in shunt field at high speeds, and the motor and rheostat have their maximum efficiency at all speeds with this method of regulation.

A third method of speed regulation is a combination of the above two, as shown in Fig. 3. With this plan the normal speed of motor is selected at some point between the highest and lowest speed. Speeds above the normal are secured through the use of rheostat in shunt winding, and speeds below the normal by means of a rheostat in armature circuit. This method of regulation gives a maximum efficiency at normal and all higher speeds, but efficiency drops rapidly at speeds below the normal.

The Harlan and Hollingsworth Company.

At a recent meeting of the Board of Directors of The Harlan & Hollingsworth Company, Wilmington, Del., to fill the vacancy in the office of president, caused by the death of the late J. Taylor Gause, Mr. H. T. Gause was elected president; Mr. H. W. Gause, vice-president and secretary, and Mr. J. Rodney Gause to the vacant directorship. The above, with Mr. S. K. Smith, treasurer, and Mr. T. Jackson Shaw, superintending engineer, comprise the Board of Directors.

The present organization of the plant is as follows: Mr. W. F. Carnes, assistant superintending engineer; Mr. E. B. Sadtler, superintendent of hull construction; Mr. J. Rodney Gause, assistant superintendent of hull construction; Mr. Thomas Benson, superintendent of dock and repairs.

This company has recently contracted with the N. Y. & Porto Rico S. S. Co. for a companion steamer to the "Ponce," to be named the "San Juan," and also with Boulton, Bliss & Dallett, of the Red D Line, for a twin-screw freight and passenger steamer, length over all 277 feet, beam 37 feet, depth, 18 feet 6½ inches.

Similar to the Machinery Business.

"Is literature a business or a profession?" "A profession when you are writing, and a business when you are trying to sell what you have written."—"Philadelphia North American."

The "Sun" of this city enumerates the following recent foreign orders for steel rails:

The Maryland Steel Company, for Siberia, two orders, one for 35,000 tons and the other for 80,000 tons of steel rails.

The Maryland Steel Company for Australia, two orders, one for 14,000 tons and the other for 32,000 tons of steel rails.

The Illinois Steel Company, 15,000 tons of steel rails for Japan.

The Carnegie Steel Company, 30,000 tons of steel rails for South Africa.

The Lackawanna Company, 5,000 tons of steel rails for Australia.

Illinois Steel Company, products other than steel rails, 10,000 tons.

The Carnegie Company, products other than steel rails, 85,000 tons.

R. D. Wood & Co., products other than steel rails, 9,000 tons.

John Hankin, owner of a steam heating plant in this city, was, on January 5, fined $25 for burning soft coal. The case was the first result of a crusade inaugurated by the Board of Health.

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No back Numbers beyond 1898.

Business Notices.

The "American Machinist" will not pay commission to advertising agents hereafter. We furnish, gratis, the services of advertising writers who make up copy weekly for our advertisers. We propose to take as much pains to make the advertising columns interesting and attractive as we do the editorial. Agents serve the advertiser only, if they serve anyone, and the advertiser should pay the freight.

Back Numbers.

Only a few copies of each issue for 1898 are left (November 3d entirely exhausted). Parties wishing to fill out their missing copies should order at once, as none will be kept after March 1.

Bound Volumes.

Bound volumes for 1898 will be ready in a few days. The number is limited. Orders filled in their turn. They never last a month.

Skilled Labor for Skilled Work.

The queer ideas entertained by some people as to the importance of employing skilled men to perform skilled labor is illustrated by the plan followed by a manufacturer in one of our Eastern States in handling automatic screw machines. He put in six of them and soon found that, on the short pieces he was making, there was apparently little for the skilled mechanic he had at first employed to do. Occasionally he saw him putting in a new bar of stock, and sometimes he saw him grinding or setting a tool, but it seemed to our eagle-eyed proprietor that he was just standing about doing nothing most of the time. True, the machines were doing even better than the makers' guarantee, both in respect of limit of variation and in number of pieces turned out; but that made no difference; our proprietor thought he knew when a man was earning his money and when he was not, and he discharged the high-priced expert who had been recommended by the builder of the machines, and went to "John," his "trusty engineer, who always did just what he was told to do," offered him 50 cents a day more if he would, in addition to running the engine and doing his own firing, wheeling out ashes, etc., run those six automatics which "you see, John, are right here, close to the engine, and you can just keep your eye on all of them at the same time as easy as not, and make your little three a week extra."

John started, and apparently all went well. The production fell off a little at once, which caused some uneasiness, but a few figures on a pad showed that the falling-off could be four times as great before the saving in wages would be balanced; and besides, it was confidently believed that "when John got the hang of things he would bring the production up to its former mark, and perhaps beat it a shade." The production, however, continued to fall off. John seemed to have more and more trouble with the machines and was always able to convince our bright employer that the difficulty was not with the man but with the machines, which he declared were defective and weak, and that he no more than got them fixed up in one place than something was the matter with them at another. Finally they not only would not keep up their rate of production, but their product became so inaccurate that the limit of variation was exceeded, and a large percentage of the work began to come back as unsatisfactory. Finally, all the machines seeming to have gone on strike and unanimously refusing to work, the letters of complaint that had been sent to the builders of them were followed by a "vigorously worded," that is to say an impertinent, telegram, and an expert took the next train for the scene of the trouble.

He soon discovered that "John" was simply an ignorant jammer with no mechanical training whatever, and with no natural taste for mechanics which would have enabled him to learn to handle the machines properly, even supposing that he had had nothing else to attend to. Everything about the machines capable of being spoiled had been spoiled, and all the original tools had been ruined and replaced by others that could not possibly do good work.

By the time these machines were again brought up to good condition a few more figures on a pad told our proprietor a story that caused his countenance to be "sicklied o'er with the pale cast of thought," and he realized the important fact that it is possible for mechanics to be doing good and valuable work without being constantly bathed in perspiration.

There are shops in which the sight of a workman wearing decent clothes, keeping himself clean and cool and sitting down occasionally while at work at bench or machine, is apparently a serious offense, and where the only conception of an efficient workman is one who appears to be always "hustling" and always in grease and dirt up to his eyes. Such shops must acquire some new ideas before automatic screw machines, grinding machines and other tools of that nature can be successfully operated in them. Because such machines are often fed by unskilled men in good shops, it must not be inferred that no skilled or intelligent attention is given to them.

Post Mortem Revelations of the Keely Motor.

We cannot but rejoice at the additional revelations which have been made of the "mysteries" of the Keely motor. These later revelations are the results of an investigation of the building occupied by Keely as a workshop, and in which the exhibitions of his apparatus were made from time to time. The undertaking was instituted by the *Philadelphia Press*, and was conducted by a number of eminently competent persons, including the reporters of the newspaper, Prof. Carl Hering, consulting electrical engineer; Prof. Arthur W. Goodspeed, assistant professor of physics of the University of Pennsylvania; Prof. Lightner Witmer, professor of experimental psychology, of the same institution, and eminent as a student of and authority upon delusions; Dr. M. G. Miller, Coleman Sellers, Jr., and Mr. Clarence B. Moore, son of the late Mrs. Bloomfield Moore, so much of whose money had been absorbed in the Keely schemes.

The facts brought out by the investigations were, after all, only such as could have been easily discovered by less eminent and talented men, if they had been permitted to do so. The building was of a type quite common in Philadelphia. It was a two-story structure, built on a low foundation without cellar, and was 18 feet front and 45 feet deep; the upper story being, however, only 40 feet deep. There

were three rooms on the ground floor and two rooms above, with stairway and hall, and an office partitioned off from the front room above. Every particle of the flooring and ceiling was torn out and the walls were closely examined. A lot of trap doors were found in the floors, varying in size from 1x1½ feet to 3x6 feet. Five of these were in the front room on the ground floor, four in the middle room, and one in the back room, while on the second floor there was a 3½-foot trap door in the center of the front room, a 4x4-foot trap in the center of the back room, and seven small traps distributed about other parts of this floor. Under the floor of the middle room on the ground floor there had been previously discovered a hollow spherical vessel, said to be of steel, to weigh three tons and to be capable of sustaining an internal pressure of 25,000 pounds to the square inch. This vessel was near one of the trap doors and was buried in earth and shop refuse. To put it in the place where it was found, sections of two of the floor beams had been cut away and afterwards replaced. The vessel had a hole in the top tapped for pipe. Four feet away from this, and with an end just within the trap door, was a piece of heavy iron pipe, 14 feet long, with elbows on each end. Under the other trap doors nothing was found but heaps of ashes lately placed there. A false ceiling of wood had been put into one of the upper rooms, with a space of 2 inches between the boards and the timbers where pipes or wires might have been concealed, but none were found there. The floor of the back room up stairs was somewhat higher than that of the others, and on tearing this up, a piece of small tube, at first thought to be wire, was found running through holes bored in the floor beams. Mr. Sellers had previously found a similar piece of tube built into the partition wall almost opposite to where this was found. This had been put in after the wall was built, as the plaster was different from the original. The small tubes found are identical in size and appearance to others which appeared attached to the Keely machine, and which he asserted were merely wires for transmitting the vibratory movements.

This investigation we can scarcely avoid regarding as somewhat of the character of an autopsy. The facts discovered speak for themselves in a way which makes it quite unnecessary for us to offer a word of comment. These things are found after those who are still financially interested in the motor have taken away every portion of the apparatus that was ever visible to the public and much that was never exposed. If an investigation of the entire plant could have been permitted, it seems certain that functional relations could have been traced between the heretofore visible portions and those now for the first time revealed. Why should these things have been concealed? If there are those who can conceive that the concealment was consistent with any honest purpose, we are not to be counted with them, and there never has been a day when we could have been counted with them. While for so long a time the Keely motor, and the performances connected with it, were so prominently and so persistently kept before the public, it came in our way from time to time to speak of the matter, but we have never said anything calculated to foster any hope that there could ever come out of it anything commensurate with the claims advanced, or in fact anything of value to the world. Mr. Keely's ways were not the ways of an honest and truthful man, nor the ways of an inventor or discoverer of anything great, and that he was so long successful in his career is one of the marvels of the age, and all his apparatus is well deserving of a place in some museum where it may stand as a warning to the over credulous, whom, like the poor, we have always with us.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(10) F. H. H., Bedford, Ind., writes: I want to build a small steamboat, stern wheel, and the wheel driven by a chain, and I want to know the strain on the chain. The wheel is 5 feet diameter with 18 blades, each 8 inches wide and 3½ feet long, driven by a sprocket wheel on the same shaft, 18 inches diameter. What would be the pull, in pounds, on the chain with the wheel making 50 rotations per minute and the boat tied fast? A.—Sexton's formula for the thrust of a paddle wheel, with the boat moving at any speed is:

$$\frac{64\ (A \times V)}{32} \times (V - v), \text{ or}$$

$$2\ (A \times V) \times (V - v).$$

Here A is the area of one blade of the wheel in square feet, V is its mean velocity in feet per second, and v is the velocity of the boat. With no movement to the boat it would therefore be:

$$2\ (A \times V) \times V, \text{ or } 2\ (A \times V^2).$$

The area of the blade is $\frac{2}{3} \times 3\frac{1}{2} = 2\frac{1}{3}$ square feet. Assuming 5 feet to be the extreme diameter of the wheel, the diameter at the center of the blades is $4\frac{1}{3}$ feet, and the velocity will therefore be $4\frac{1}{3} \times 3.1416 \times 50 = 680$ feet per minute, or $680 \div 60 = 11\frac{1}{3}$ feet per second, and, by the formula above, the thrust will be $2 \times 2\frac{1}{3} \times 11\frac{1}{3}^2 = 599.4$ pounds. As this thrust is at the center of the blades, or at a radius of 26 inches, the thrust or pull on the sprocket wheel of 9 inches radius will be 9 : 26 :: 599.4 : 1,731.6 pounds. This computation deals really with the column of water that is moved, so that it is only necessary to consider the single blade, the others, either wholly or partially immersed, being assumed to assist in moving the same column of water. There is, however, an additional resistance to be overcome in forcing the forward blades down into the water and in the lifting of a considerable body of water as the blades rise, but for these conditions there is no satisfactory formula. If the boat was moving at one-half the speed of the wheel, the thrust by the above formula would be only one-half of that here obtained, and in similar proportion for any other speed.

(11) S & R., Philadelphia, asks: What is the best process for hardening cast iron? A.—We do not know what the best process is, but some methods of doing the work were described in our issues of April 9, 1887; February 25 and March 10, 1888, and are briefly as follows: (1) Heat the cast iron to a good cherry red, apply potash and dip into water, the same as is done in the case of wrought iron. (2) Use prussiate of potash, then heat and cool three or four times, using the potash each time. Care must be taken in heating lest unequal cooling break the piece. (3) By heating the cast iron to a bright red heat and immersing in pure lard oil.

Personal.

Dr. Coleman Sellers, C. E., M. E., has removed his office in Philadelphia to 1301 Stephen Girard Building.

Mr. Henry T. Boyden, of Elyria, Ohio, who has been representing Manning, Maxwell & Moore, has resigned that position.

Mr. H. H. Lane, recently of Troy, N. Y., has been engaged in the engineering department of Westinghouse, Church, Kerr & Co., of this city.

Mr. J. B. Hall recently superintendent of the New Birdsall Company, of Auburn, N. Y., has engaged as general foreman of the machine shop of the F. C. Austin Manufacturing Company, Harvey, Ill.

Messrs. Gregg & Barrell, Standard Building, P. O. Box 938, Johannesburg, South Africa, are engaging in the sale of American goods at that place, and would be pleased to receive catalogs with prices of American machinery.

Mr. M. J. Martinez has received the appointment as resident agent at Havana, Cuba, for The Hancock Inspirator Company, manufacturers of injectors, ejectors, general jet apparatus, etc. The business will be conducted under the style of M. J. Martinez, Consulting and Contracting Engineer.

Obituary.

Frank H. Purington, the principal machinist of Brunswick, Me., and proprietor of a small shop there, died January 16; fifty-three years old.

James L. Ellis, foreman of the Philadelphia & Reading Company's East Pennsylvania shops at Reading, Pa., died in

that city January 16, fifty-eight years old. He was for many years master mechanic of the Boston & Maine Railroad, with headquarters at Hartford, Conn.

W. H. Bennett, one of the original partners of the foundry firm of Root, Bennett & Co., Indianapolis, Ind., later the Indianapolis Stove Company, died January 16, seventy-one years old. He was born in Albany, N. Y., and went to Indianapolis in 1853. He was stricken with apoplexy three years ago and since then had been incapacitated for business.

John G. Herzel, a life-long machinist, died at Wilmington, Del., January 15; eighty-four years old. He was born in Germany, and was for some years chief machinist of the Austrian-Danan Steamship Company, and later came to this country, being employed by the Harlan & Hollingsworth Company, and later by Pusey & Jones. He started a machine and blacksmith shop in 1856, but all his prospective profits went into various unremunerative inventions.

David Greene, secretary and treasurer of the Case Manufacturing Company, Columbus, Ohio, died in this city January 14; thirty-two years old. Mr. Greene graduated from Princeton College at about twenty years of age, and having purchased an interest in the above company, first worked in the various departments for three years and then became its secretary and treasurer, which offices he held up to the time of his death. Mr. Greene inaugurated and put in force in the business many details of system which proved their value in saving of labor and in convenience over previous arrangements. Two destructive fires also occurred, when he showed his abilities in the rapid rebuilding, and after the second fire the entire plant was practically entirely rebuilt and in full operation in sixty days. Mr. Greene personally was highly esteemed by all his associates.

Places for Ship Draftsmen.

The United States Civil Service Commission gives notice that from the examinations to be held on February 7, 8, 9 and 10 a large number of places as draftsman and assistant ship draftsman are to be filled at various points.

The Commission desires to obtain as many applicants as possible for this examination, so that it will result in the establishment of an eligible register sufficient to meet the needs of the service, and it therefore urges all persons who are qualified to at once make application for the necessary blank forms and full information relative to the examination.

Applicants are advised that arrangements will be made to examine them in any city in the United States where the Commission has a Board of Examiners, and that they will be given the examination if they will advise the Commission by letter or telegram, stating where they desire to be examined, in sufficient time to ship examination papers. They will be permitted to file their applications subsequently if necessary. The age limit for entrance to these examinations is 20 years or over. J. J. Vogel, Philadelphia Post Office, is secretary of the local Board of Examiners.

Inquiry for Machinery.

Those who make, or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiry as follows:

(91) Machines used in the manufacture of fishing nets.

The Alfheim Company, of Christiania, Norway, are about to open a permaneat exhibition of machinery, and they invite American machinery manufacturers to correspond with them regarding space, etc. This firm has already made a success of a permanent exhibition of building materials in the same place.

A new engineers' society has been formed in England called the Society of Model Engineers. Its object is to be the discussion of matters relating to the construction and working of model engines, dynamos, motors, steam and electric launches, tools, and small electrical and mechanical apparatus generally.

Dr. Gatling's 8-inch cast steel gun, the successful preliminary trial of which was mentioned in our issue of December 22, burst on January 4, while being tested for accuracy with the maximum charge of powder, 142 pounds, a projectile of 350 pounds, and a pressure of 37,000 pounds per square inch.

Commercial Review.

NEW YORK, SATURDAY EVENING,
January 21, 1899.

VERDICT OF A JAPANESE IMPERIAL COMMISSIONER ON AMERICAN MACHINERY.

We have the pleasure, this week, of announcing an event of more than trivial moment in its bearing upon the future of American machinery in Japan. Mr. T. S. Horiye, general manager of H. S. Tanaka & Co., Tokyo, importers of machinery and contractors for the Imperial Government, has arrived in New York on his way home from Europe, after an investigation of the comparative merits of European and American machinery in the interests of his firm, and also as commissioner for that purpose of the Japanese Government. He is now making his headquarters at the rooms of the Japan-American Commercial and Industrial Association, "Times" Building, and he leaves, January 23, for Vancouver on his way home.

While in America previous to his visit to Europe, Mr. Horiye communicated with hundreds of manufacturing companies. Subsequently he has passed through England, France, Belgium and called at certain works in Germany. The result of his investigation has been radically favorable to American products.

"I have been struck by the variety and improvements of your machinery," says he, "your machine tools, your engines and your electrical machinery. I found in Europe practically nothing that was new. At one time England was a progressive nation in machinery building, but now she has yielded the palm to the United States. In Germany I visited the Algemeine Elektricitäts Gesellschaft, where American methods are being followed, and that was the only up-to-date electrical manufactory I found. In the United States I am purchasing some samples of machine tools and other machinery. I have taken the agencies for certain firms, including the exclusive Japanese agency for Westinghouse, Church, Kerr & Co., one of whose engines I shall have sent to Japan. In the future I shall probably have occasion to purchase machinery for some electric railways."

"The result of my investigations as regards our private house will be that whereas in the past I have been buying machinery chiefly from England, I shall hereafter look to the United States. The effects of my report as a commissioner of the Japanese Government will be indirect, but its tendency cannot be otherwise than for a betterment of the export trade of the United States with Japan."

H. S. Tanaka & Co. bear the reputation of being one of the most important and responsible machinery importing houses in Japan.

THE MACHINE TOOL MARKET.

The critical point of the season has safely been passed. The new year has progressed far enough to show a satisfactory demand for machine tools all along the line since the holiday period. The volume of business closed up thus far has not been phenomenal, but it has been good, and the indications are still better. There is every reason to expect that this year will prove a record-breaker for machine tools.

It is coming to be the rule that the buyer of machine tools seeks the seller. Formerly the seller had to go hunting for buyers and to flush them like partridges.

Prices continue to exhibit a strengthening tendency. This is the time, if any, to insist upon better compensation for machinery. A certain planer company, through advances made to take effect part about the first of last month and part at the first of next month, will receive more than 15 per cent. better returns than formerly. It must be acknowledged, how-

ever, that its old rates were considerably below those of its competitors. A Western company has within a few days past increased the price of drilling machines. Several important companies maintain conservative prices at all times, and are unaffected by the present disposition to advance.

"A man came to me lately to inquire for a tool," remarks the chief of a Liberty street house, "and he did not even ask the price. All he cared about was the time of delivery. The party referred to is a manufacturer of railway supplies, and at present his orders are so heavy that he regards them as abnormal and is reluctant to make extensive additions to his plant, for he fears that the boom cannot last."

Two large equipments to which machinery people in the New York district are looking forward are those for shops of the Central Railroad of New Jersey and of the New Jersey Dry Dock and Transportation Company. Although the plans for neither appear yet to be quite definitely fixed, it is likely that both will eventually be erected, the probable site for each being Elizabethport, N. J. Some contracts of importance have lately been given out by John H. Starin for his new steamboat shop.

A man just returned from a business trip among machinery and tool interests in the West is wildly enthusiastic over the state of activity there prevailing since the opening of the year. Business is rushing in Chicago, he says, and Cincinnati is deluged with work. One company in the latter city he reports to be nine months behind hand with orders for planers.

The New York representative of one of the machine tool companies has just returned from a trip to Boston, and reports a feeling of confidence among almost all classes of users of machine tools. While the year's trade had hardly yet materialized, they were cheerful and confident. To this our informant noticed one exception—the manufacturers of textile machinery; but no doubt his opportunities for observing that line were restricted.

Mr. Wesselmann, representing the Wesselmann Maschinen Gesellschaft, which controls several plants in Germany engaged in the manufacture of mining, oil well and other machinery, is staying at the Belvedere House, Fourth avenue and Eighteenth street, New York. He is in this country to purchase machine tools and other machinery for the works of the company and also for shipment to China and Japan, upon a basis of cash against bill of lading. His visit may also result in the establishment of permanent relations with some American manufacturers.

A local house handling a miscellaneous line of tools was making, this week, four European shipments, as follows: To Manchester, England, bicycle tools, including grinders, spoke heading machine, tumbling barrels, screw cutters, a ball case grinding machine, etc.; to London, miscellaneous small tools and supplies; to France, ten engine lathes; to Berlin, upright and sensitive drills, tapping machines and lathes. The same company will ship to England within a few days a 54-inch

(*Continued on page 36.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear wheels, gear cutting, Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.MachT.Co., Meriden, Ct.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

The finest punches and dies; send for samples. Waltham Mach. Works, Waltham, Mass.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N.J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas, Prov.R.I. Send for index sheet.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Geared punching press, No. 32, almost new, in good order, Toledo Machine & Tool Co., makers; $200. Geo. S. Sturges, Scranton, Pa.

One Niles boring and turning mill, with two heads, been in use six months, for sale at $1,900. Inquire of The Patterson Tool & Supply Co., Dayton, Ohio.

For Sale—Iron planing machine, to plane 48 inch by 42 inch by 24 feet; two heads on cross-rail; made by Gleason Tool Co., of Rochester. Apply to The Holly Manfg. Co., Lockport, N. Y.

I have a new hand tool for wood workers which has merit and will sell; wish to arrange with responsible parties for its manufacture and sale on a royalty basis, or will sell outright. F. W. Steele, 84 8th ave., West, Cedar Rapids, Ia.

Two mechanics with long experience in the machine-tool business have designed a line of vertical spindle milling machines superior to anything as yet on the market; would like to interest some capitalist in their manufacture. Address Box 31, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

For Sale or Rent.—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

First-class draftsman desires position. Box 46, AMERICAN MACHINIST.

Foundry foreman wishes position; experienced, heavy or medium castings. Box 37, AMERICAN MACHINIST.

Gas engine designer and mechanical draftsman, four years' experience, desires change. Box 40, AMERICAN MACHINIST.

Position wanted by a strictly first-class diemaker; would like a job in the city of Chicago. Box 39, AMERICAN MACHINIST.

Mech. grad., 9 years' exp., draftsman machinist, elec. work, steady worker, desires position. Box 45, AMERICAN MACHINIST.

Wanted—Position by mech. draftsman, exp. in stat. engine construction and designing; good references. Box 32, AMER. MACHINIST.

Position wanted by a first-class blacksmith, age 34; exp. 16 years; thoroughly competent to take charge of shop. A. D. Childs, Danville, Pa.

Wanted—Engagement with responsible party, by an expert machinist and tool maker; good manager and cost-cutter; age 32; South, West or abroad pref. Box 42, AMER. MACH.

Cashier and bookkeeper in large engine works in West desires change; best reasons; thorough, modern cost-keeper; tech. grad.; references. Address Box 47, AMER. MACH.

Position wanted as electrical or mechanical engineer with manufacturer, consulting engineer or contractor; tech. grad., 5 years' exp. in design, construction and instal. of elec. machinery. Address Box 48, AM. MACH.

Notice—Mfg. gas engine designer has a simple exhaust valve operating mechanism, no gears, cams, levers or revolving shafts, but use direct action with eccentric and rod; new, novel, good; on royalty with position. Automatic Gas Engine, Grand Rapids, Mich.

A first-class position in the East as stenographer or private secretary, is desired by a young lady of exceptional business ability, thoroughly conversant with the clerical work of the manufacture of machinery; best of references from present employers. Address Box 38, AMERICAN MACHINIST.

Help Wanted.

Wanted—Six first-class machinists. Address The F. M. Davis Iron Works Co., Denver, Col. Wages $3 per day.

Owner of well-equipped machine shop wants hustling partner, or would form stock company. Box 41, AMERICAN MACHINIST.

Wanted—First-class tool dresser who thoroughly understands hardening and tempering; steady position for the right man. Box 43, AMERICAN MACHINIST.

Wanted—Foreman molder, foreman machinist and foreman shipbuilder (steel); state experience and salary expected; steady employment for right man. Box 49, AM. MACH.

Experienced mechanical draftsman wanted to work on Staten Island; must be able to make original designs and figure strains; apply by letter only. Address C. W. Hunt Company, West New Brighton, S. I.

A tool maker, A1 on dies, jigs, etc.; must be up in modern methods of making tools for rapid production in light and accurate manufacturing; state age, experience and wages expected. Address Diamond Meter Co., Peoria, Ill.

Wanted—Three first-class, all-round machine blacksmiths and tool dressers; skillful men of good habits can have steady work. Address in own writing, giving references, experience and wages expected, Atlanta Machine Works, Atlanta, Ga.

Wanted—A first-class designer and practical mechanic who thoroughly understands the manufacture of motor carriages in all its details; to the right party a good position is open; all communications treated in confidence if so desired. Address, with full particulars as to age, experience, salary, etc., Automobile, AMERICAN MACHINIST.

Apprentices—A few additonal apprentices, 16 to 17 years of age, will be received by R. Hoe & Co., printing press manufacturers, to learn the machinist's trade in its various branches; attendance at the firm's evening school three evenings each week is expected. Apply personally or by letter, R. Hoe & Co., 504 Grand st., New York.

(*Continued from page* 35.)

square by 18-foot planer, probably by Way of Boston. An inquiry for a 54-inch planer has just come to it from France.

WOOD-WORKING MACHINERY.

Signs are visible that the lethargy which for several years past has hung over this branch of industry has begun to break. The inquiries current this month are quite uniformly reported as more numerous than hitherto, and sellers feel that the prospects for an active spring are excellent. While January trade has been good, and in some cases shows improvement over December, the cheerfulness prevalent in the market is due rather to the outlook than to the actual volume of business closed. It seems that wood-workers, after long depression, are beginning to get back into such shape that they require new tools. Some lines are much better than others. Furniture and piano makers are busy, while the sash and blind mills in the large cities are doing little. Car builders are very hard at work, but are pretty well supplied with machinery. The demand from railroads for new machinery is good. Among those now said to be in the market is the Southern Pacific. The Central Railroad of New Jersey is likely to place orders after a little while. Navy yards have been buying well, and continue to do so. Following the big rush orders of last year, they are looking for odds and ends that have been neglected.

In the New York district, as well as elsewhere, there is some improvement in inquiry. A machinery agent expresses his opinion that the number of new wood-working mills that are starting up about here is increasing and balances those that are going out of business. As an instance of the distribution of local trade may be cited the experience of another house, which out of $1,800 worth of machinery sold for this territory during the present month, supplied twenty-seven different parties. This apparently did not include what the same concern is said to have received of the orders which are being placed by John H. Starin for the equipment of his new steamboat shops on Staten Island.

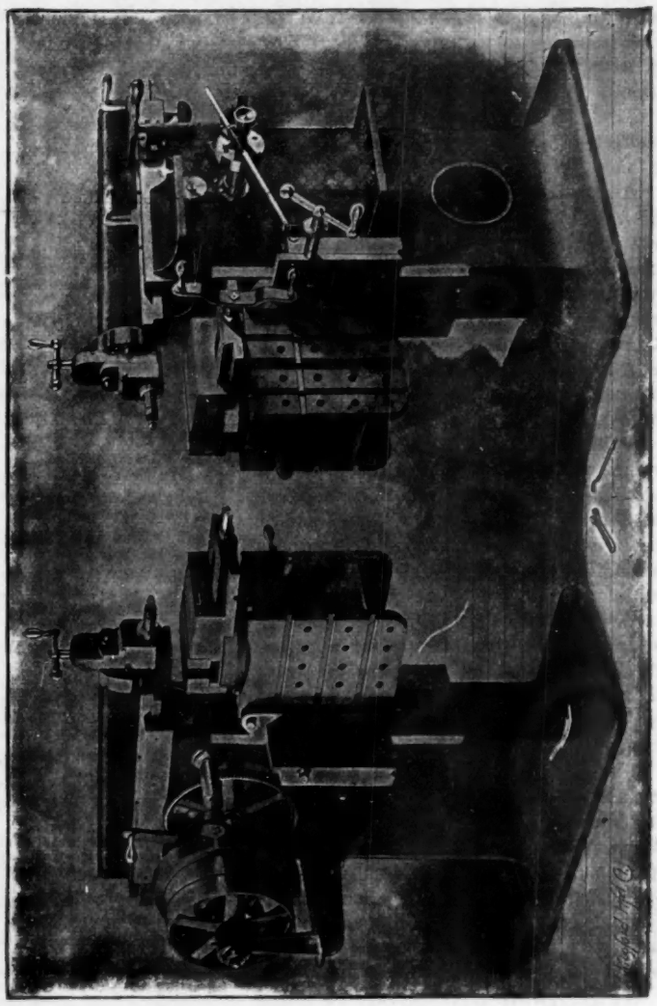
"There always seems to be some particular tool," remarks one seller, " for which there is an especial demand. Just now it is a planer and matcher. I know of nine inquiries for them at present. Jointers and band saws sell readily at all times."

An improved demand for wood-working machinery is reported from the Pacific Coast.

MACHINERY EXPORTS FOR NOVEMBER.

The "Monthly Summary of Finance and Commerce" issued by the Bureau of Statistics, Treasury Department, for November, 1898, shows that during that month was exported from this country metal-working machinery to the amount of $579,378; for November, 1807, $360,329; for eleven months ending Novem-

15=INCH PILLAR SHAPER.



A FRICTION driven machine, fitted with a positive locking device for friction, insuring a uniform length of stroke under a heavy cut. Stroke can be changed to any position with ram in motion; has quick return; and our micrometer adjustment makes possible the most minute variation in length of stroke, which can be constantly varied with machine in motion; an especially valuable feature in tool and die work and in planing to irregular lines.

THE HENDEY MACHINE CO.,
TORRINGTON, CONN.

AGENTS FOR THE PACIFIC COAST:
PACIFIC TOOL AND SUPPLY CO., ... San Francisco, Cal.
J. W. CREGAR, ... Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:
SCHUCHARDT & SCHUTTE, ... Berlin, Vienna, Brussels.
CHAS. CHURCHILL & CO., Ld., . . . London and Birmingham, England.
ADOLPHE JANSSENS, ... Paris, France.

Our Annealed Die and Tool Steel

Saves Time, Labor, Money.

Crescent Steel Company,

Pittsburgh, Pa.
Chicago, Ill.
New York, N. Y.
Denver, Col.

COMPARE WEIGHTS

WHEN YOU ARE TOLD THAT JENKINS' '96 IS MORE EXPENSIVE THAN OTHER PACKINGS.

Average weight 1/8 inch "Jenkins '96," 11 lbs. to the square yard.
" " 1/8 " Red Packing, 14 " " " "

At 50c. per pound "JENKINS' 96" is not only very much cheaper, but the best joint packing manufactured.

JENKINS BROS. NEW YORK, BOSTON, PHILADELPHIA, CHICAGO.

LOCOMOTIVE MECHANISM AND ENGINEERING.

Third edition, revised and enlarged. With an appendix on the Modern Electric Locomotive. By H. C. REAGAN, Locomotive Engineer. 12mo. Cloth. $2.00. Upwards of 450 pp. 226 figures, including many half-tones.

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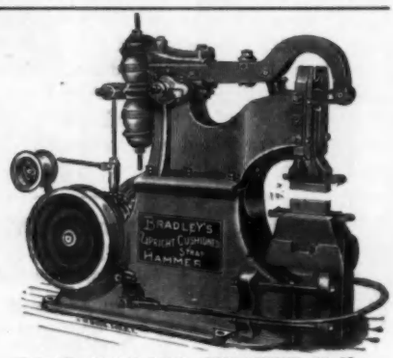
Schuchardt & Schutte, Berlin, Vienna, Brussels.



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MILLING CUTTERS

DIES AND CUTTING TOOLS

are more satisfactory when made from HOBSON'S (FH) "CHOICE" TOOL STEEL.

MADE ONLY BY
HOBSON, SEAMAN & COMPANY,
SUCCESSORS TO
FRANCIS HOBSON & SON, SHEFFIELD,
American Warehouse, 98 John St., New York.
CHAS. HUGILL, Agent.
Correspondence solicited.

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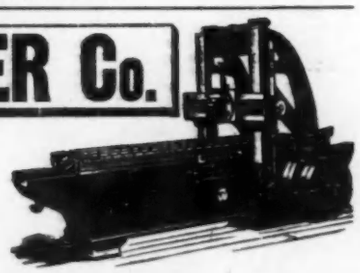
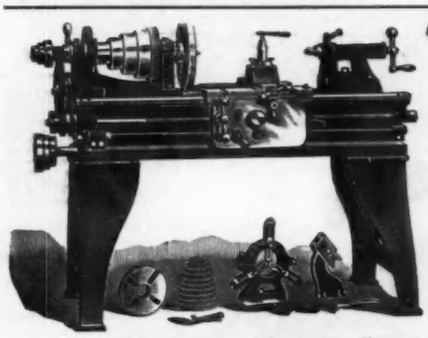
WORCESTER, MASS.



AGENTS:
U. Baird Machinery Co., 125 Water St., Pittsburgh, Pa.
J. A. Fay & Egan Co., 26 South Canal St., Chicago, Ill.
Robinson & Cary Co., St. Paul, Minn.
W. R. Colcord Mchy. Co., 502 North 2d St., St. Louis, Mo.
Parke & Lacy Co., Fremont St., San Francisco, Cal.
The Fairbanks Co., 705 Arch St., Philadelphia, Pa.



"Sebastian" Lathes

(13 and 15 inch swing).

Beds Any Length Desired.

High grade, modern lathes at a low price. Each lathe is provided with both screw and rod feeds, as well as power cross feed. Gears to cut all standard threads from 5 to 36 are furnished.

Workmanship, material and design are of the highest order.

You can't find anything better.

We also make a specialty of Screw Cutting Foot Lathes.

Sebastian Lathe Company,

117 & 119 Culvert St., Cincinnati, Ohio.

AGENTS.—Selig, Sonnenthal & Co., London, Eng.; Jn. Tragardhoh & Co., Goteborg, Sweden. E. Sonnenthal, Jr., Berlin, Germany; R. S. Stokvis & Zonen, Rotterdam, Holland.

ber, 1898, $5,321,886. The figures for October, 1898, have previously been reported, $651,256. Electrical machinery exports were: November, 1898, $336,723; November, 1897, $171,668; October, 1898, $286,818; eleven months ending November, 1898, $2,276,197. Locomotive engines: November, 1898, thirty-six in number, valued at $258,340; November, 1897, twenty-two, at $167,983; October, 1898, forty-three, at $326,156; eleven months ending November, 1898, 553, at $4,922,189; eleven months ending Novemer, 1897, 329, at $2,915,060. Stationary engines: November, 1898, thirty-four, aggregating in value $15,505; November, 1897, thirty-five, at $21,136; October, 1898, forty-four, at $30,552; eleven months ending November, 1898, 472, at $324,711; eleven months ending November, 1897, 511, at $332,743. Boilers and parts of engines: November, 1898, $79,740; November, 1897, $94,581; October, 1898, $105,285; eleven months ending November, 1898, $1,087,316; eleven months ending November, 1897, $622,497. Printing presses and parts thereof: November, 1898, $75,893; November, 1897, $39,218; October, 1898, $66,234; eleven months ending November, 1898, $738,384; eleven months ending November, 1897, $615,092. Pumps and pumping machinery: November, 1898, $205,304; November, 1897, $138,094; October, 1898, $193,886; eleven months ending November, 1898, $2,014,471. Sewing machines and parts thereof: November, 1898, $204,439; November, 1897, $213,992; October, 1898, $181,617; eleven months ending November, 1898, $2,824,635; eleven months ending November, 1897, $2,895,453. Typewriters and parts thereof: November, 1898, $179,008; November, 1897, $140,581; October, 1898, $178,734; eleven months ending November, 1898, $1,893,333; eleven months ending November, 1897, $1,402,362. Shoe machinery: November, 1898, $69,950; November, 1897, $55,732; October, 1898, $66,125; eleven months ending November, 1898, $854,365.

A LETTER ON GEARS.

From the Philadelphia Gear Works: "The year just closed we find on balancing up was the best since we have been in Philadelphia, six years now. We have done more business and have lost fewer accounts through failures than any other year, and altogether feel very well satisfied with the world in general. Our export trade is very limited, nearly all being done through export houses in New York. We find that it is cheaper, considering everything, to do so, as we ship to New York and draw at once on the people there, where we used to ship direct and get all kinds of money and at all times. There seems to be no particular line of trade that is buying gears more freely than others, and we should say that by our orders nearly every line was busy. Prices are not as high as in former times, but we constantly strive to keep adding and im-

proving our machinery to produce more for the same money. Our hours of work are on a somewhat novel plan, and it seems to work well, the regular hours being ten each day, except Saturday, when we shut down at 12 o'clock, or 5, just as the majority of the workpeople say, and the strange part of that is there has been no running Saturday afternoon for nearly a year."

CHICAGO MACHINERY MARKET.

An Iowa machinist was in the city last week, selecting some small tools for the equipment of a repair machine shop. He remarked that there was no shop within fifteen miles of him and that there was not a threshing machine outfit within that radius that would not need extensive repairs before it could be operated this year. He thought the chances for work in his neighborhood were good, and therefore he had decided to start a repair shop. This machinist is one of many. Small machine shops are dotting the Western prairies much more thickly than common in recent years. A representative of a large local implement works, while riding recently on a passenger train from St. Paul, was asked what the outlook for trade in his line was. Directing the attention of the inquirer to the rich agricultural country through which they were passing, he pointed to one machine after another which had been left out in the winter weather by its owner, and laconically remarked that as long as the farmers treated their machines in that way there was no fear for the future of the implement trade. But the present improved condition of the machinery trade in the farming regions is due rather to the larger crops and the better prices than to the fact that the American farmer has not wholly learned the lesson of economy, as applied to machinery.

Current machinery trade, while showing recuperative force in the way above noted, is better known for development in another direction, namely, the equipment of large machine shops. The demand is for large machines. These are the sizes that are short among the makers. Local houses have a fair assortment of small tools, but are deplorably deficient in the more powerful machines. The house that is fortunate in this respect is the one that is doing the trade. There have been a number of recent instances wherein large buyers, asking for tools, accepted an inferior machine which could be furnished immediately, rather than wait a few weeks for a machine of recognized worth. One reason for this condition of affairs is that the revival of the machine trade occurred earlier in the East than in the West, and when the Western buyer came to purchase he could not comprehend why the stocks of tools were so depleted. The recent sales of large machines have in a majority of instances been intended for the equipment of additions to old plants, and neither to the displacement of old machines nor to the equipment of new plants. There is scarcely in the West a manufacturer of any importance who is not now or has not recently made extensive additions to his shop. The complaint is general that for desirable machines of the larger sizes deliveries cannot be made within several months.

J. B. Doan & Co. have recently sold outfits for the extension of the Chicago Shipbuilding Company's shops, including lathes up to 54-inch swing; for the shops of the F. M. Davis Iron Works, of Denver, including three carloads of engine lathes, drills and grinders; machinery for a new line of brass work for Studebaker Bros. Manufacturing Company, South Bend, Ind., etc.

Last week about 115 Chicago machinists and engineers visited the shops of the Niles Tool Works Company, Hamilton, O., as the guests of that company. They left Chicago in a special train of four coaches under the care of Messrs. George F. Mills and A. L. Guilford, representatives here of the company. About sixty of the guests were railroad men; the others were connected with various Western iron-working plants.

Quotations.

NEW YORK, Monday, Jan. 23.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @ 12 50
No. 2 foundry, Northern	11 25 @ 11 75
No. 2 plain, Northern	11 00 @ 11 50
Gray forge, Northern	10 50 @ 10 75
No. 1 foundry, Southern	12 00 @ 12 25
No. 2 foundry, Southern	11 50 @ 11 75
No. 3 foundry, Southern	11 25 @ 11 50
No. 1 soft, Southern	12 00 @ 12 25
No. 2 soft, Southern	11 50 @ 11 75
Foundry, forge, Southern	10 75 @ 11 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.10 @ 1.12½c.; refined, 1.15 @ 1.25c. Store prices: Common, 1.35 @ 1.40c.; refined, 1.40 @ 1.50c.

Tool Steel— Base Sizes—Standard quality, 6 @ 7c., with lower prices on some brands; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.50 @ 1.55c.

Cold Rolled Steel Shafting—Base, sizes, from store in small lots, 2.15c. upward.

Copper—Carload lots, Lake Superior ingot, 15¾ @ 16c.; electrolytic, 15½c.; casting copper, 15¼c.

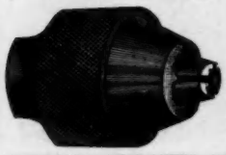
Pig Lead—Carload lots, 4.20 @ 4.25c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 24¾ @ 25c., f. o. b. New York.

Spelter—In carload lots, 5.40 @ 5.50c., New York delivery.

Antimony—In cask lots, 8.75 @ 9.50c., according to brand.

Lard Oil—Prime city, present make, the leading brand, 46 @ 48c., in wholesale lots.



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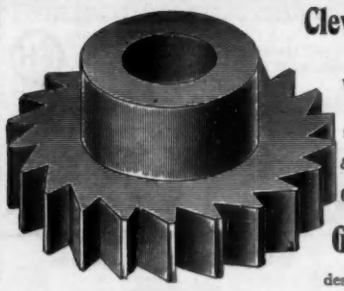
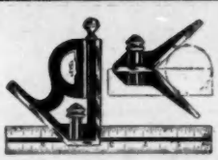


Cleveland Gear Works
W. R. SAWYER, Lessee.
86 Seneca St., Cleveland, Ohio.
GEARS of all descriptions.



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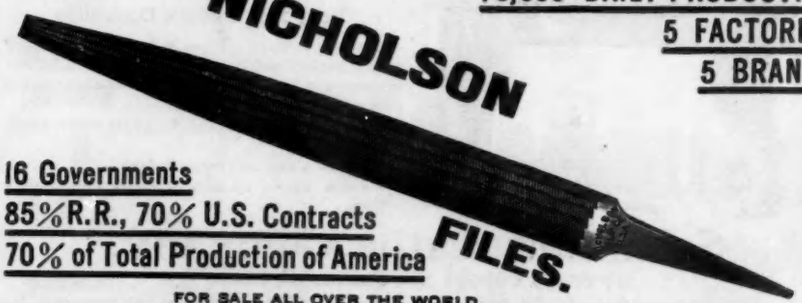

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